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REPORT

OF THE

FEDERAL TRADE COMMISSION

ON THE

ıcific Coast Petroleum Industry

PART I

PRODUCTION, OWNERSHIP, AND PROFITS

April 7, 1921

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

REPORT

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Pacific Coast Petroleum Industry

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PRODUCTION, OWNERSHIP, AND PROFITS

April 7, 1921

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1921

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FEDERAL TRADE COMMISSION.

HUSTON THOMPSON, *Chairman*
NELSON B. GASKILL.
JOHN GARLAND POLLARD.
VICTOR MURDOCK.
JOHN F. NUGENT.
J. P. YODER, *Secretary*.

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8-19-1930

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FEDERAL TRADE COMMISSION,
Washington, April 7, 1921.

To the PRESIDENT OF THE SENATE.

SIR: The Federal Trade Commission submits herewith Part I of a Report on the Pacific Coast Petroleum Industry, which is made pursuant to Senate resolution 138, Sixty-sixth Congress, first session.

This part deals with production, ownership, and profits. The second part, which is in course of preparation, will discuss prices, marketing methods, and competitive conditions.

The outstanding facts regarding the Pacific coast petroleum industry shown in this part of the report may be concisely stated as follows:

(1) Owing to the scarcity and high prices of coal, petroleum products, especially fuel oil and gasoline, are probably of more importance to industry and commerce on the Pacific coast than in any other large section of the country.

(2) California, however, is one of the largest petroleum producing States; its output has rapidly increased, and there are no present indications of a decline in the near future.

(3) Recently, i. e., from June, 1915, to January, 1921, demand has exceeded supply, with a consequent steady reduction of stocks, but since the beginning of this year production has exceeded consumption and stocks have increased slightly.

(4) The oil land "withdrawals" ordered by the Government in 1909, for the purpose of reserving a supply for the Navy and in order to suspend the patenting of oil lands until the public land laws could be revised, did not prevent overproduction down to June, 1915, but from then until 1920 had probably a somewhat retarding influence on the development of new production.

(5) All branches of the petroleum industry on the Pacific coast, i. e., crude petroleum production, pipe-line transportation, and refining and marketing, are dominated by a few large interests which control most of the proven oil lands and operate nearly all the pipe-line and refining equipment.

(6) The costs of producing crude petroleum vary widely between different fields and between different companies in the same field. The chief factor in cost seems to be the volume of production per well. The large companies as a group have the more productive wells and show the lowest average costs.

(7) There was a great increase in the costs of production of crude petroleum between 1914 and 1919 for all classes of companies; there was also a marked increase in the cost of transportation by pipe line and in the cost of refining.

(8) The profits of the crude petroleum industry of California were comparatively low in 1914 and 1915, but they were unusually large

in 1918 and 1919. This increase in the average rate of earnings resulted from a great advance in crude petroleum prices. While the average rates of earnings from the crude-petroleum business in the later years were large, the fact that there was a scarcity of crude, resulting from a steady growth in demand, appears to afford an adequate economic explanation of the increase in prices and earnings.

(9) With respect to gasoline, kerosene, fuel oil, and other products of crude petroleum, the factors affecting prices were more complex and conclusions as to their reasonableness are reserved to the second part of this report, which deals particularly with such prices.

(10) The earnings of the five large integrated companies, namely, the Standard Oil Co. (California), the Union Oil Co. of California, the Associated Oil Co., the Shell Co. of California, and the General Petroleum Corporation, which are engaged in crude petroleum production, pipe-line transportation, refining, and marketing of gasoline, fuel oil, and other petroleum products, and which are the dominating factors in this industry on the Pacific coast, were generally low in 1914 and 1915, but they all show either very good or very high rates of earnings in 1918 and the first half of 1919.

(11) Data regarding the results of the petroleum industry for the whole country for the entire year 1919 indicate that the situation as to profits in the California petroleum industry was not exceptional compared with other sections of the United States in that year.

(12) While the petroleum shortage of 1919 and the first part of 1920 seems to have been temporarily met, both on the Pacific coast and in the United States as a whole, the problem of an adequate petroleum supply for the future does not appear to be fully solved and the Commission reiterates certain recommendations which it made in a report to the House of Representatives on June 1, 1920, namely, (*a*) that the active support of the Government be given to those engaged in the oil industry to develop production in foreign countries; (*b*) that methods of drilling for petroleum and the utilization of petroleum products and their substitutes should be a subject of special study in technological and economic aspects with a view to conserving the supply; (*c*) that the great importance of information regarding changes in industrial and commercial conditions in the oil trade suggests the need of making provision for having such information currently collected and reported for the use of Congress, the public, and the industry.

Respectfully,

HUSTON THOMPSON, *Chairman.*
NELSON B. GASKILL.
JOHN GARLAND POLLARD.
VICTOR MURDOCK.
JOHN F. NUGENT.

SUMMARY.

ORIGIN AND SCOPE.

This Report on the Pacific Coast Petroleum Industry is made in compliance with Senate resolution 138, Sixty-sixth Congress, first session. This resolution directed the Commission to ascertain the causes for the advance in the market prices of the principal petroleum products in the United States, and especially such advances in the Pacific coast territory; to report the sources of supply of crude petroleum for the United States, and particularly for the Pacific coast; to show the corporate or other agencies which produce, refine, and market the crude petroleum and its products, giving particular attention to those activities of the Standard Oil Co. (California), the Union Oil Co. of California, the General Petroleum Corporation, and other companies engaged in the various branches of the petroleum business of the Pacific coast; to ascertain the profits of said business; and to determine whether combinations in restraint of trade exist between those engaged in the various branches of the petroleum business of that section; and, if such combinations have existed or exist at the present time, to state what effect, if any, they have had upon the market prices of petroleum products, and to report the results to Congress. The resolution specified that particular attention be given to the period 1914–1919.

The present part of this report (Pt. I—Production, Ownership, and Profits) deals with the supply of crude petroleum for the Pacific coast territory and for the United States; discusses the effects of the withdrawal of oil lands from disposition under the mineral land laws upon the production of crude petroleum in the State of California; describes the organization, affiliations, investments, and earnings of the large interests that dominate the petroleum business of the entire Pacific coast; presents in detail the investments, costs, and earnings for the production, transportation, and refining of petroleum; and, for the purpose of comparison, gives a general survey of the profitableness of the producing and refining branches of the petroleum industry of the entire country for the year 1919. The second part of this report will discuss the prices of crude petroleum, of fuel oil, and refined petroleum products in the principal markets on the Pacific coast, the methods of distribution and of marketing such products, and the conditions of competition in the entire Pacific coast territory.

PETROLEUM SUPPLY.

The supply of crude petroleum for the United States is almost entirely obtained from two sources—first, from the production of its own oil fields; and, secondly, from imports, which are almost entirely secured from Mexico. The production of the United States was

443,402,000 barrels in 1920, while the net imports of crude petroleum—i. e., imports less exports—amounted to 97,418,000 barrels, or 18 per cent of the crude petroleum consumed in the United States in that year. While the United States has been securing increasing quantities of crude petroleum by importation, it has exported very large quantities of refined products. The net exports of refined products—i. e., exports less imports—were 64,464,000 barrels in 1920. Prior to 1920 the net quantity exported as refined products exceeded the net imports, but in 1920 for the first time there was an excess of net imports, namely, 32,954,000 barrels, if bunker fuel oil be not considered. In recent years there has been a very rapid growth in the quantities of fuel oil laden on vessels engaged in foreign trade, which in 1920 amounted to 26,335,000 barrels. Doubtless a considerable proportion of these totals was used by vessels flying the flag of a foreign nation and really constitute export shipments. Hence, even in 1920 the United States probably exported almost as large quantities of petroleum products as it imported in the form of crude petroleum.

The entire Pacific coast territory has during the period 1914–1920 secured its supply of crude petroleum and fuel oil from the State of California, and such refined products as gasoline and kerosene have generally been obtained from the same source of supply. In the latter part of 1919 and during the first three quarters of 1920 a shortage of gasoline occurred, during which time refiners and marketers in the Wyoming, Mid-Continent, and Mexican oil fields were drawn upon for quite large supplies to supplement the production of California. The large increase in the production of crude petroleum in California, which began the latter part of 1920 and has continued through the early part of 1921, promises to again enable California to supply the demand for the entire Pacific coast territory.

PRODUCTION OF CRUDE PETROLEUM.

In 1909 large areas of oil lands in California and other States were temporarily withdrawn from disposition under the public land mineral laws. The main reasons for the withdrawal of these lands were to preserve the oil lands from disposition under the placer mining law pending the enactment of legislation by Congress providing for a more satisfactory method of mineral-land administration, to reserve a supply for the Navy, and to prevent overproduction and the consequent waste of crude petroleum. The withdrawal had only a slight effect in checking the development of oil lands in California for the first five years, as there continued to be an overproduction of crude petroleum in that State from 1910 to the middle of 1915. The withdrawal, therefore, did not adversely affect the California oil industry during that period, but was rather a means of preventing a greater overproduction than would have been the case, and lessened the waste due to storage to some extent. Since June, 1915, however, the withdrawals apparently had some effect in lessening production. The opening up of the withdrawn lands during 1921 under the recently enacted mineral land leasing law is expected to lead to an increase in the annual production of crude petroleum in California, if there is no diminution in demand.

California has produced a larger aggregate quantity of crude petroleum than any other single State, and during recent years it has ranked either first or second in the quantity of its annual production. In 1920 it produced 105,721,000 barrels, which is its largest annual production up to the present time, and constituted 23.8 per cent of the total output of the United States. There was an overproduction of crude petroleum in California from 1910 to the middle of 1915 and large quantities were placed in storage. Beginning in 1915 and continuing through 1920 the annual consumption of California crude petroleum has exceeded its annual production. Even with the record of 105,721,000 barrels in 1920, consumption exceeded production by about 8,240,000 barrels. At the present time, 1921, due to the discovery of new oil pools and the resumption of development of "withdrawn" lands, production has been increased to such an extent that, should the present rates of production and consumption be maintained, the 1921 output will again exceed consumption.

California crude petroleum generally contains a much smaller gasoline content than that produced in other oil fields of this country, and a considerable percentage of the crude petroleum is sold directly for fuel purposes. In recent years, however, the proportion of lighter gravity crude petroleum, which contains a higher gasoline content, has increased, namely, from 45 per cent in 1910 to 69 per cent in 1914, since which time its proportion has fluctuated from 65 to 68 per cent. This increase makes it possible to obtain a larger percentage of gasoline, but it lessens the proportion of fuel oil. An adequate supply of petroleum is more important for the Pacific coast than for any other section of the country, as it constitutes the main or only source of fuel for heating purposes, marine and river navigation, public utilities, railways, and for mining and manufacturing industries. Even its dependence upon gasoline and other motor fuels is greater than in any other section for use by the agricultural and horticultural industries. California supplies most of the industries of Arizona, California, Nevada, Oregon, and Washington with fuel and refined products. The absence of an adequate supply and the relatively high price of coal make fuel oil a very important factor in the entire Pacific coast region.

CONTROL OF THE INDUSTRY.

Every branch of the petroleum industry from the ownership of oil lands to the distribution of refined products is controlled by a few large interests. In the ownership of oil lands and the production of crude petroleum there are seven large interests, namely, the Union Oil Co. of California, the Associated Oil Co.-Southern Pacific interests, the Standard Oil Co. (California), the Shell Co. of California, the General Petroleum Corporation, the Doheny companies, and the Santa Fe Railway.

The seven large interests named above owned 68 per cent of the proven oil lands in California on March 1, 1920, while in 1919, according to the California State Mining Bureau, there were 345 different concerns engaged in the business of producing crude petroleum. In that same year these seven interests produced practically 71.5 per cent of all the crude petroleum production of the State. Three of these, namely, the Associated Oil Co.-Southern Pacific inter-

ests, the Standard Oil Co. (California), and the Union Oil Co. of California, owned 51.5 per cent of the proven oil lands and produced 52 per cent of the State's total production; while these three interests, together with the Shell Co. of California and the General Petroleum Corporation, own 58.5 per cent of the proven oil lands and produced 62 per cent of the 1919 production.

Five large companies, viz, the Standard Oil Co. (California), the Union Oil Co. of California, the Associated Oil Co., the Shell Co. of California, and the General Petroleum Corporation, are the only important factors in the transportation of crude petroleum by pipe line and tank steamers, in petroleum refining, and in the distribution and marketing of petroleum products in the Pacific coast territory. These large interests own and operate practically all of the trunk pipe lines in California. Prior to 1914 the pipe-line capacity was at times not sufficient to transport the current production, but from 1914 to 1920 the carrying capacity of the pipe lines has greatly exceeded the current production. These same interests own almost 94 per cent of the fixed investment in petroleum refineries, 89 per cent of the rated daily refining capacity, and in 1919 refined 91 per cent of all the crude petroleum consumed by refineries in California.

COST OF CRUDE PETROLEUM.

This report shows in detail the cost of producing crude petroleum for 96 companies in 1914 and for 119 companies in 1919. In 1914 the costs cover 57.7 per cent of the total production of California, while for the first half of 1919 they include 81.2 per cent. The cost of producing crude petroleum increased gradually each year from 1914 to 1919. For all companies combined the average cost was 27.4 cents per barrel in 1914 and 46.3 cents per barrel in 1919, which is an increase in average cost of 69 per cent. The detailed cost statements show the total cost divided into its chief elements, namely, lifting expense, general and administrative expense, depreciation, and depletion. The lifting expense includes all expenses incurred in raising the crude petroleum from the oil wells and delivering it into the producers' receiving tanks. In the case of flowing wells this expense is very low per barrel, while for very deep wells which require pumping and yield a small production this expense is large. For example, in 1914 one company having flowing wells shows a lifting cost of only 1 cent per barrel, while another company, whose wells required pumping, shows a lifting cost of $0.72. The first company had an average production of 915,500 barrels per well for the year, while the second produced only 3,300 barrels per well.

As a rule the companies having the largest annual production show the lowest cost of producing crude petroleum. The companies producing over 1,000,000 barrels per year show an average cost of $0.245 per barrel in 1914 and $0.425 in 1919; companies producing from 250,000 barrels to 1,000,000 barrels had an average cost of $0.286 per barrel in 1914 and $0.499 in 1919; the average cost for companies producing from 50,000 to 250,000 barrels per year was $0.493 per barrel in 1914 and $0.749 per barrel in 1919; while the producers which had an annual production of under 50,000 barrels produced at an average cost of $0.721 per barrel in 1914 and $1.212 per barrel in 1919. Some small companies, however, had very low costs.

The chief factor affecting cost appears to be the volume of production per well, but the cost of drilling wells and the cost of investment in oil lands, which affects the amount of depreciation and depletion, is sometimes an important factor. In 1914, for example, companies producing 100,000 barrels per well or over show an average cost of $0.034 per barrel, while those producing under 5,000 barrels per well had an average cost of $0.473 per barrel. In the first case the lifting cost was only $0.017 per barrel, while for the companies having the smallest production per well it was more than eight times as large.

There is a very wide range in the costs for individual companies. In 1914 the lowest cost per barrel was $0.031, and the highest sixty-three times as great, or $1.96; while in 1918, the last complete year for which costs are shown, the range was from $0.14 per barrel to $5.36. Neither the very low nor the excessively high costs are representative. The lowest cost in 1914 was due to a very large production from flowing wells, while the abnormally high cost in 1918 was the result of a small production for that year for a company having a very large investment, which resulted in a very high cost per barrel for depletion. Some of the companies showing very low costs in one year had relatively high costs in other years, and the same is true for companies having very high costs. While in 1918 the cost of producing crude petroleum for individual companies ranged from $0.14 to $5.36 per barrel, 55 per cent of the total production covered by the report was produced by 20 companies at a cost not exceeding $0.42 per barrel, slightly more than 89 per cent was produced by 40 companies at a cost of not more than $0.568 per barrel, and the cost of only 3 per cent of this production, representing the output of 41 small companies, exceeded $1 per barrel. For different fields there are wide differences in the average costs.

EARNINGS FROM PETROLEUM PRODUCTION.

The crude-petroleum industry is consequently one of very variable returns. In each year from 1914 to 1918 there were many companies whose costs were in excess of the prices at which they sold their crude petroleum. Thus, out of the 96 companies reporting in 1914, there were 47 companies which lost money, and out of the 134 companies reporting in 1918 there were 28 companies which showed a loss. In each case, however, the production affected was comparatively small; thus 17.9 per cent in 1914 and 1.6 per cent in 1918 of the total quantity reported was produced at a loss. The very speculative character of crude-petroleum production for companies beginning operations or for companies without a large established production is made clear by the detailed figures given in the report.

This part of the report shows the earnings for the producing, pipeline, and refining and marketing branches of the petroleum business of the Pacific coast. The investment used in the determination of the rate of earnings for the petroleum business includes all the capital employed in such business, including bond issues and other borrowed money, while the earnings include only the income from the petroleum business before deducting interest and Federal taxes. The rate of earnings for the first half of 1919 is shown on an annual basis.

Departmental earnings are shown for the five large integrated companies for their producing, pipe-line, and refinery and marketing

departments. In most cases statements were furnished by the companies showing such earnings. Departmental earnings are always more or less arbitrary and are of interest only in determining the relative profitableness of the different departments of the business and for purposes of comparison with companies engaged in only a single branch of the industry. In the case of the large integrated companies for both the crude-petroleum producing and pipe-line departments there is no question as to the basis of determining the earnings; for the producing department the current market price of crude petroleum at the producer's tank in the oil fields was used, while pipe-line transportation earnings were computed on the basis of the published tariff charges.

Taking only companies engaged exclusively in the production of crude petroleum, the average profit on investment was 7.2 per cent in 1914 and 20.3 per cent in 1919. If the crude petroleum-producing departments of the large integrated companies were put on a basis of selling their product at the market prices, the rate of earnings would have been 8.2 per cent in 1914 and 32.2 per cent in 1919, and the average profit combined with that of other producers reporting would amount to only 7.6 per cent for 1914 and 26.7 per cent for 1919. As shown above, the average rate of earnings was low in 1914. In that year 47 companies, representing almost 43 per cent of the net investment and producing about 18 per cent of the output covered for that year, show a loss, while about 32 per cent of the net investment and 27 per cent of the production show average earnings of only 4.5 per cent, and only 20 companies, owning about 25 per cent of the net investment and producing 55 per cent of the production, earned in excess of 10 per cent. The following year was even less profitable. The depressed condition of crude petroleum producing business in these two years was the result of the large overproduction, which lasted until about the middle of 1915. Beginning with 1916 there was a marked improvement, which continued throughout the remainder of the period. The largest earnings are shown for the first half of 1919, when there were 21 companies, with only 1.2 per cent of the net production and owning 3.9 per cent of the net investment, that show a loss, while 68 companies, with slightly more than 83 per cent of the net investment and 95 per cent of the production, earned in excess of 10 per cent. For the five and one-half year period an average of 43 companies, owning almost 20 per cent of the net investment and producing 9 per cent of the production, show a loss, while companies owning 57.7 per cent of the investment, producing 74 per cent of the production, earned in excess of 10 per cent.

PIPE-LINE TRANSPORTATION.

Five large interests, viz, the Standard Oil Co. (California), the Associated Oil Co., the Union Oil Co. of California, the General Petroleum Corporation, and the Shell Co. of California either own directly or through subsidiaries practically all of the trunk pipe-line mileage of the State of California. The combined mileage of their trunk pipe lines aggregate about 2,450 miles and with a gross investment of almost $50,000,000. Their rated daily capacity is about 380,000 barrels, which is sufficient to transport 138,700,000 barrels annually, or 33,000,000 in excess of the 1920 production for the State.

The cost of constructing trunk pipe lines is greater in California than in other sections of the country. For example, an 8-inch pipe line built in California in 1915 cost about $18,800 per mile, while the same size of line in the Mid-Continent field would have cost about $10,250.[1] This higher cost of construction is partly due to the fact that it is necessary to equip the pipe lines in California with heating facilities, which are used to raise the temperature of the crude to about 150° in order to facilitate its flow through the lines, and partly to the necessity of placing the trunk pipe-line pumping stations about 15 miles apart as compared with approximately 40 miles in the Mid-Continent field.

The costs of transporting crude petroleum by pipe line, according to information furnished by the companies, increased for most companies. The costs for shipment from the San Joaquin Valley fields to San Francisco Bay points increased from $0.142 per barrel in 1914 to $0.213 for the first half of 1919 for one company, while another company shows an increase from $0.115 to $0.221 for the same years; this represents an increase of about 50 per cent for one company and almost 100 per cent for the other.

All of the pipe lines from the California oil fields are intrastate lines, hence they were not made common carriers by the Hepburn Act placing interstate pipe lines under the jurisdiction of the Interstate Commerce Commission. However, the State of California in 1913 enacted legislation declaring pipe lines common carriers. Some of the pipe-line companies voluntarily filed tariffs with the State railway commission. While two companies contested the jurisdiction of the State railway commission, one was judicially held to be a common carrier and the other a private carrier and not subject to the jurisdiction of the railway commission.

The pipe-line rates that have been named by the companies filing tariffs originally conformed closely to the railroad rates and disregarded entirely the cost of the service plus a reasonable return on the investment in the pipe-line properties. Rates from the different San Joaquin Valley fields to San Francisco Bay points are now 35 cents per barrel for distances ranging from about 200 to 300 miles, while the rates for short distances, for example, about 30 miles, range from 8 to 10 cents per barrel. Since the pipe-line companies have not transported crude petroleum as common carriers, except in the case of a subsidiary, which has transported only for the parent company, the rates have been of interest only to the different departments of the five large companies.

The rates of earnings for the pipe-line departments of the large integrated companies as reported by them have generally been higher than for other departments. The different companies have credited their pipe-line departments with earnings at the published tariff rates. The Standard Oil Co. (California) shows rates of earnings on the net investment of the pipe-line department varying from 25.2 per cent in 1914 to 22.6 per cent for the first half of 1919, with a maximum rate of earnings of 70.8 per cent in 1917. The average for the period was 40 per cent. The rates of earnings for the Associated Oil Co.'s subsidiary pipe lines decreased from 31.1 per cent in

[1] Federal Trade Commission, Report on Pipe Line Transportation of Petroleum, pp. 55 and 59.

1914 to 12.1 per cent in 1919, with a maximum of 41.7 per cent in 1915 and an average of 29.2 per cent. The Union Oil Co. of California shows earnings ranging from 11.1 per cent in 1915 to 11.3 per cent in 1919, with a maximum of 18.8 per cent in 1916 and an average for the period of 9 per cent. The Shell Co. of California took over the pipe lines of the Valley Pipe Line Co. in 1917. Its rate of earnings for 1918 was 30.1 per cent, for the first half of 1919 it was 35.9 per cent, while the average for the period was 32 per cent. The General Pipe Line Co., which is controlled by the General Petroleum Corporation, earned 18.6 per cent in 1916 and 14.9 per cent in 1917, while a loss of eight-tenths of 1 per cent is shown for 1918, and a loss of 6.8 per cent for the first half of 1919 with an average rate of profit of 6.7 per cent. This unfavorable showing in the last two years was doubtless due to the small volume of crude petroleum transported as the result of the exchanges of large quantities of crude petroleum in the San Joaquin Valley fields for crude produced in the Whittier-Fullerton field. The pipe-line earnings for the large companies have generally declined during the period 1914–June 30, 1919, which is due to the fact that the rates except in one case remained constant while the cost of operation increased.

COST OF REFINING.

Five companies, viz, the Standard Oil Co. (California), the Union Oil Co. of California, the Associated Oil Co., the Shell Co. of California, and the General Petroleum Corporation, at the end of 1919 owned and operated 15 refineries representing a gross investment of $47,000,000, out of a total for the State of $50,000,000. These refineries had in 1919 a rated daily capacity of almost 275,000 barrels out of a total of about 308,000 barrels and refined 66,445,000 barrels of the State's total of 72,618,000 barrels. In other words, these five companies owned 94 per cent of the gross investment in refineries, operated 89 per cent of the rated daily refining capacity, and in 1919 consumed 91 per cent of the crude petroleum refined.

As already stated, California crude petroleum yields a smaller percentage of gasoline and naphtha than is generally secured from the crude petroleum produced in other fields, but in recent years the percentage obtained has increased considerably. From 1916–1920 the proportion obtained has increased from 11.7 to 15.4 per cent. This increase was partly due to the larger percentage of light refinable crude petroleum produced in California, which increased from 65 per cent in 1916 to about 70 per cent in 1920, and partly to the efforts of the large refiners to increase the gasoline and naphtha yields through the use of the Burton process and other improved methods of refining. The effect of both of these factors has been somewhat obscured, however, by the practice of refining heavier crudes than formerly; these heavier crudes yield a very small proportion of gasoline and naphtha.

The cost of refining crude petroleum is shown in detail for the five companies named above for the period 1916–June 30, 1919, and for two of the companies from 1914 to the latter date. The cost of refining a barrel of crude petroleum, including the cost of the crude, for all companies combined increased from $0.738 per barrel in 1916 to $1.259 for the first half of 1919; this represents an increase of 71 per cent. The crude petroleum costs are taken at the actual cost of

production, if produced, or at purchase price, if bought. There was a wide range in the costs for individual companies. In 1916 the lowest cost for a particular company was $0.602 and the highest $0.845, which represents a difference of $0.243, or 40 per cent, while in 1919 the lowest cost was $0.95 and the highest $1.631, which gives a difference of $0.681, or 71.7 per cent. The companies showing high costs are those purchasing a large proportion of the crude petroleum they refine.

The principal element of cost for a barrel of refined petroleum products is the raw material—crude petroleum—even when the crude is charged to the refinery at its cost of production plus transportation cost. On this basis the raw material represented 79.4 per cent of the total cost in 1914 and about 74 per cent in 1919. The refinery operating expense was about 13.5 per cent in 1914 and 17.7 per cent in 1919, while the general and administrative and depreciation combined were 7.1 per cent in 1914 and 8.3 per cent in 1919. The refining labor cost is a very small factor in the cost of a barrel of refined petroleum products, and during the period covered it varied from only $0.012 in 1914 to $0.046 in 1919.

The advantages possessed by the large integrated companies over companies engaged in refining only is made apparent by a comparison of the combined integrated costs shown for the five large companies, i. e., crude charged to their refineries at actual producing and pipe-line transportation cost, with costs computed on the basis of crude petroleum at the current market prices in the oil fields, plus transportation charges at published tariff rates. For all companies for which costs are shown their cost of refining a barrel of crude petroleum would have been $0.24 per barrel, or 32 per cent higher in 1914, had they not owned crude petroleum production and pipe lines; while in 1919 it would have been $0.69 per barrel, or 55 per cent greater. Hence it is evident that it is practically impossible for a refiner without low-cost petroleum production and pipe lines, unless the refinery is near the oil field, to become an important factor in the petroleum industry in California.

EARNINGS FROM REFINING AND MARKETING.

Earnings statements for the refining and marketing departments of three of the large integrated companies were prepared by the companies on the basis of charging the crude petroleum to the refineries at its current market price, including pipe-line transportation charges at published tariff rates, while the Commission has computed earnings on the same basis for one of the other companies in order to secure comparable results. This results in showing larger profits for the pipe line and production departments and correspondingly lower profits for refining and marketing. No departmental earnings are presented for the General Petroleum Corporation, because its refining and marketing activities are not comparable with those for other four companies, and such departmental earnings, if shown, would be misleading.

The departmental earnings on the net refining and marketing investment of the Standard Oil Co. (California) on the above basis varied from 4.4 per cent in 1914 to 18.1 per cent in 1919, while in 1918 it was 25.4 per cent. The average for the period 1914–June

30, 1919, was 10.5 per cent. The Union Oil Co. of California shows that earnings on its marketing and refining investment increased from 3.9 per cent in 1914 to 17.3 per cent in 1919. The average for this company for the five and one-half year period was 9.1 per cent. The Associated Oil Co. shows a loss on its refining and marketing investment ranging from 10 per cent in 1914 to 17.1 per cent in 1917, while beginning with 1918 there was a profit shown which amounted to 22.8 per cent for the first six months of 1919. This company shows an average loss of 3.4 per cent in these departments for the entire period. The Shell Co. of California shows very small profits on its investment in 1916 and 1917, while in 1918 there was a loss of 10 per cent, and for the period 1916–June 30, 1919, there was an average loss of 8.4 per cent.

The Standard Oil Co. (California) and the Union Oil Co. of California were well established in the refining and marketing field at the beginning of the period, and they show substantial earnings for their refining and marketing investment even when the crude petroleum which they produced is charged to the refinery at market price plus the pipe-line tariff rates. The Associated Oil Co. was essentially a producing and fuel oil marketing company prior to 1914. It built its principal refinery in 1913 and began marketing gasoline and other petroleum products about that time and had not become an important factor in these branches during the earlier years. The Shell Co. of California was organized in 1915 and began operating its first refinery during the latter part of December, 1915. It entered the marketing field during 1915, and, like the Associated Oil Co., it did not become an important factor in the refining and marketing branches of the petroleum business of the Pacific coast until during the last two years of the period. The losses shown for these two companies for their refining and marketing departments, on the basis of the produced crude at market price and all crude transported at the published tariff rates, illustrate the handicap encountered by a company not having crude production and pipe lines in attempting to establish itself in the refining and marketing branches of the industry.

EARNINGS OF LARGE COMPANIES.

The rates of earnings on investment for the five large integrated companies, including all of their activities in the petroleum business, are presented in this report in compliance with the resolution directing the investigation. The earnings for all of the activities of these companies in the petroleum business are the most significant figures, as a loss may be shown for one department and a large profit for another.

The investment used to show the company's earnings from the petroleum business only includes the capital stock, surplus, and funded debt, and excludes investments in affiliated and other companies; while the earnings are those shown before the deduction of interest on funded debt or of Federal taxes, and excludes interest and dividends received. For the Commission's revision all appreciation and deferred charges have been eliminated from investment, adjustments have been made in depreciation and depletion, and other minor items, such as incidental drilling, were capitalized, while the earnings were modified by the elimination of income from sources

outside of the petroleum business and depreciation and depletion adjustments were made to put these items on a uniform basis.

The earnings from the petroleum business, as shown by the records of the Standard Oil Co. (California), varied from 10.4 per cent in 1914 to 22.5 per cent in first half of 1919, with an average rate of earnings for the entire period of 17.4 per cent. The rate of earnings for the Union Oil Co. of California, as shown by its records, varied from 4.8 per cent in 1914 to 16 per cent in first half of 1919, with an average of 10.9 per cent for the entire period. The records of the Associated Oil Co. show a rate of earnings of 2.8 per cent in 1914 and 15.5 per cent in first half of 1919, the average rate for the period being 8.3 per cent. The General Petroleum Corporation's records show earnings of 4.4 per cent in 1916, 29.4 in 1918, and a loss of 0.5 per cent for the first half of 1919, while the average rate for the period was 15.7 per cent. The rate of earnings for the Shell Co. of California, as shown by its records, varied from one-tenth of 1 per cent in 1915 to 10.1 per cent in first half of 1919, while the average rate for the entire period was 3.9 per cent.

The Commission's revised rate of earnings from the petroleum business for the Standard Oil Co. (California) increased from 12.2 per cent in 1914 to 30.8 per cent in first half of 1919, with an average of 22.4 per cent for the period. The revised rate of earnings for the Union Oil Co. of California increased from 5.1 per cent in 1914 to 21 per cent in first half of 1919, with an average of 13.5 per cent. The Associated Oil Co: on revision shows an increase from 3.5 per cent in 1914 to 17.6 per cent in first half of 1919, with an average of 10.2 per cent. The Commission's revised earnings for the Shell Co. of California show a loss of 3.2 per cent in 1915 and a profit of 15.5 per per cent for the first half of 1919, with an average profit of 10.4 per cent. The General Petroleum Corporation earned 7.3 per cent in 1916 and 14.3 per cent for the first half of 1919, with a maximum of 37.9 per cent in 1918 and an average of 24.5 per cent for the period, according to the Commission's revision.

The Commission's revision shows that the rates of earnings for the five large integrated companies from the petroleum business were generally low in 1914 and 1915 or that some of them incurred losses, while beginning with 1916 there was generally a rapid increase until in 1918 and the first half of 1919 the rates of profit for each company were quite large.

The question of the reasonableness of prices for the various petroleum products will be disoussed fully in Part II. However, in an industry such as the petroleum business, which produces a large number of different products, the reasonableness of prices can only be satisfactorily answered after the profits of the business have been ascertained. The price of a particular product, such as gasoline, may be advanced and appear unreasonably high without increasing the margin obtained by the refiner, if other products decline in price or costs increase without corresponding increases in the price of other products. As already pointed out, by far the most important element in the cost of a barrel of refined petroleum is the cost of the raw material—crude petroleum. During the period 1914–June 30, 1919, the price of crude petroleum in California advanced greatly, and at the present time, April, 1921, crude petroleum prices are still at the highest level ever attained. The rates of earnings for crude petro-

leum producing companies show clearly that the prices were not remunerative for a substantial proportion of the production in 1914 and 1915. In 1918 and 1919, however, such prices were advanced until this branch of the business so far as reported to the Commission, except for a small percentage of the production, was very profitable and the earnings increased from $0.17 to $0.79 per barrel. Apparently during the last half of 1919 and in 1920 this branch of the industry was also very profitable. Supply and demand conditions were such that high prices of crude petroleum appear to have been logical in order to stimulate to the utmost the production of crude petroleum.

EARNINGS FOR ENTIRE INDUSTRY.

For comparison with the foregoing data for the Pacific coast territory the following facts regarding the petroleum industry for the United States are of interest. This information was reported by the companies and was not checked with their records by representatives of the Commission, as was the case for the large companies already discussed. It was secured only for the year 1919 in connection with another inquiry in response to House resolution 501, Sixty-sixth Congress, second session, and was furnished by the companies in schedules prepared by the Commission. Fairly complete data were furnished for 82 producing companies and 138 refining companies.

A total production of 239,038,000 barrels of crude petroleum, or 63.3 per cent of the total production of 377,719,000 barrels for the United States as reported by the United States Geological Survey, was covered by these reports. Of this total reported, 224,190,000 barrels, or 59.4 per cent of the total production of the United States, was produced by 32 large companies and their subsidiaries, each of which produced over 1,000,000 barrels. These 32 companies, however, represent only 20 different interests; 9 companies are members of the Standard Oil group and the remaining 23 large independents. The 9 Standard companies produced 21.3 per cent of the total production of the United States in 1919, while the 23 large independents produced 38.1 per cent of the total. Most of these companies also refined crude oil or were closely affiliated with refining companies.

The crude-petroleum producing companies of the Standard Oil group produced 8.5 per cent of the total, while Standard companies which are also engaged in refining produced 12.8 per cent. The independent producing companies produced 6.7 per cent of the total, while the independent companies which also refined produced 31.4 per cent. For both Standard and independents the production was 15.2 per cent for producing companies and 44.2 per cent for those which also refined.

Companies belonging to the Standard Oil group owned 36.5 per cent of the total rated refining capacity of the United States in 1919 as reported by the Bureau of Mines, and they were operated at a higher percentage of their rated capacity than the independent refiners, as they refined 43.8 per cent of the total crude petroleum consumed by all refineries. The large independent refining companies reporting had a refining capacity of 43.3 per cent and consumed 41.1 per cent of the crude consumed.

The proportion of gasoline and naphtha secured from the crude petroleum from the principal oil fields east of the Rocky Mountains during 1919 was much higher than that secured in California. Refineries operating only on Appalachian crude show a yield of gasoline and naphtha of 27.4 per cent, those refining Mid-Continent crude had a yield of 27.9 and those for Wyoming obtained a yield of 22.2, while California refiners secured only 13 per cent. Refineries equipped with pressure stills secured much higher yields of gasoline and naphtha, those refining Mid-Continent crude secured 46 per cent, while from Wyoming crude 41 per cent was obtained.

The investments used to show the earnings from the petroleum business only include the capital stock, surplus, and funded debt, and exclude appreciation, the investments in affiliated and other companies, and also Government and other securities; while the earnings are those shown before the deduction of interest on funded debt or Federal taxes and exclude interest and dividends received.

On this basis the 82 companies reporting, which produced 62,162,000 barrels, showed an investment in the crude-petroleum business of $365,847,000 and earnings of $64,728,000, or a return of 17.7 per cent. A further analysis of the return from the crude-petroleum business for these 82 companies by profit groups discloses the fact that 14 of them with a production of 2.6 per cent of the total reported and an investment of 3.6 per cent showed an average loss of 2.8 per cent, while earnings of over 30 per cent are shown for 14 companies having 37.3 per cent of the production with only 15.1 per cent of the total investment. The average rate of earnings for these latter companies was 41.2 per cent, while the total for all groups was 17.7 per cent.

Of the 42 crude-petroleum companies operating in the Mid-Continent field, 6 companies with only seven-tenths of 1 per cent of the production and 1.3 per cent of the net investment showed a loss of 3.4 per cent. A profit of more than 30 per cent was shown by 8 companies with a production of 28 per cent of those reporting for this field but with an investment of only 4.8 per cent, the average rate of earnings for these 8 companies being 57.3 per cent. The average rate of earnings for the 42 companies reporting from the Mid-Continent field was 17.2 per cent, which is slightly lower than the average for all fields.

There were 138 petroleum-refining companies which submitted satisfactory reports. These covered a total crude consumption of 303,321,000 barrels or nearly 84 per cent of the total consumption for the entire country, as shown by the Bureau of Mines. These companies or affiliated interests produced 116,221,000 barrels of crude petroleum or 38.3 per cent of their refinery consumption. On a total investment of $2,088,283,000 they made a profit of $349,819,000 or an average of 16.8 per cent. The highest average rate was 27.6 per cent for 7 companies in the Rocky Mountain region with an investment of $59,887,000.

The average rate of earnings for these 138 companies on their investment in the domestic petroleum business alone averaged 20 per cent on an investment of $1,525,677,000 as against 16.8 per cent on their entire business. The refiners operating in the Rocky Mountain region on the same basis show an average rate of 32 per cent on an

investment of $48,040,000. Twenty-eight refiners consuming 3 per cent of the crude and having 1.9 per cent of the investment show an average loss of 8.5 per cent. Thirty-nine refiners with 18.7 per cent of the total net investment in the petroleum business and consuming 16.2 per cent of the crude petroleum refined by the companies reporting earned less than 10 per cent, with earnings of 5.9 per cent. There were 28 companies that earned profits of 30 per cent or over. This group refined 22.5 per cent of the crude petroleum, owned 22.2 per cent of the net investment, and showed an average rate of earnings of 34.9 per cent.

When these companies are grouped according to the magnitude of their investment in the domestic business, 5 companies with an investment of over $100,000,000 each, or a total of $722,023,000, showed an average rate of earnings of 24.6 per cent, while the lowest average rate of earnings is shown for the 31 companies with an investment of between $1,000,000 and $5,000,000. These companies have an aggregate net investment of $65,225,000 and show an average rate of earnings of 15.4 per cent. More than half of the 138 companies from which reports were obtained had an investment of less than $1,000,000 each. The aggregate net investment of these companies was $27,991,000, on which they earned an average of 17.3 per cent.

Small refiners in the Mid-Continent field claimed that they were making very small profits during 1919, particularly during the last six months of the year. The reports submitted agree with their claim, as shown by the results for 28 refiners in Oklahoma, which reported average earnings of 6.3 per cent on the petroleum business for the entire year.

During 1914 and the first half of 1915 there was an overproduction of crude petroleum for the entire country, and the prices for crude petroleum and refined products were very low. Profits in the producing branch of the industry for 1914 and 1915 east of the Rocky Mountains, as in California, were probably low. Beginning in the latter part of 1915 the prices of crude petroleum began to rise and were increased steadily, except for a decline for a few months in 1916, until they were stabilized by the industry in cooperation with the Fuel Administration in the spring of 1918. In the latter part of 1919 crude prices began to advance and the maximum general level was reached about the 1st of March, 1920. These maximum prices were maintained until January, 1921, from which time to April 1, 1921, they have been reduced about 50 per cent. It seems probable that the profits in the crude-petroleum industry generally increased from 1916, and that large profits were the rule in 1919 and 1920.

Data collected by the Commission, some of which have been published, show that for refiners generally throughout the entire country 1914 was a year of low profits. The year 1915 was a much more profitable one for refiners east of the Rocky Mountains than for those operating in California, although as in California the industry was more prosperous from 1916 to 1918. The year 1919 was also generally prosperous for the petroleum industry of the whole country except for refiners in the Mid-Continent field.

PACIFIC COAST PETROLEUM INDUSTRY.[a]

CHAPTER I.

ORIGIN AND SCOPE OF THE REPORT.

Section 1. Introduction.

RESOLUTION DIRECTING INVESTIGATION.—The investigation of certain features of the petroleum industry, with special reference to the Pacific coast, was directed by Senate resolution 138 (66th Cong., 1st sess.), introduced by Senator Poindexter, and passed by the United States Senate on July 31, 1919. The text of this resolution is as follows:

Resolved, That the Federal Trade Commission is hereby requested to investigate and report to the Senate the causes of recent advances in the market price in the United States, especially on the Pacific coast, of fuel oil, kerosene, gasoline, and other petroleum products, and in reporting the foregoing the said Commission is requested to take into consideration and report the sources of oil supply for the United States, and particularly for the Pacific coast; the annual production of the same for several years last past, with especial reference to the years 1914 to 1919, inclusive; the corporate or other agencies by which the business of oil production, oil refining, oil distribution, and oil marketing, including petroleum and all its products, is and has been conducted in the past and at the present time, with especial reference to the particular period mentioned above, and to these activities on the Pacific coast, and to the Standard Oil Company of California, the Union Oil Company, and the General Petroleum Co., and other companies engaged in this business, on the Pacific coast, and the profits of said business, and to report to the Senate what, if any, combinations in restraint of trade between those engaged in this business or unfair competition on the part of any of these or other agencies engaged in said business have existed during the said period or do exist at the present time, and if such combinations, restraint, or unfair competition have existed or do exist, what, if any, effect the same have had upon the market price of fuel oil, gasoline, and other petroleum products, especially on the Pacific coast and especially with reference to the price charged to the ultimate consumer of the same.

The language of the resolution directing the investigation covered by this report is very comprehensive and includes all phases of the petroleum industry of the entire country. The demand for the investigation grew out of increases in the price of gasoline, fuel oil, and other petroleum products on the Pacific coast, and in order to ascertain the facts regarding this situation the resolution specifies that particular attention be given to the petroleum industry of that section of the country, and that the operations of certain specified companies in California be carefully investigated. In harmony with the spirit of the resolution, the Commission has limited the intensive work of its inquiry to the petroleum industry of the Pacific coast, and more particularly to the operations of the companies named in the resolution, while a less intensive study has been made of the foreign sources of supply and of the general situation in the other oil fields of the country.

[a] Subsequent to the presentation of this report to Congress in manuscript, a few minor changes in text and figures were made in the copy submitted to the printer.

The facts developed in the course of this inquiry are being published in two parts.

SCOPE OF PART I.—Part I of this report covers the sources of supply of crude petroleum for the United States as a whole and for the Pacific coast; the effect on crude petroleum production in California of the withdrawal of oil lands from disposition under the mineral land laws; the organization, affiliations, investments, and earnings of the large integrated companies which occupy a dominating position in the petroleum industry of the entire Pacific coast territory; the cost of production of crude petroleum within the State of California; and a detailed study of the investments, cost of production, and earnings for the production, pipe-line transportation, and refining of crude petroleum for the period 1914–June 30, 1919; and for purposes of comparison a chapter is also devoted to a general survey of the profitableness of the producing and refining branches of the petroleum industry of the entire country in 1919.

In addition to this report the Commission has recently published two other reports on the petroleum industry; one, issued June 1, 1920, was made in response to House resolution 501, sixty-sixth Congress, second session, and discussed particularly the conditions in the petroleum industry east of the Rocky Mountain region,[1] while the other, issued January 3, 1921, is confined to a detailed study of the situation in the Rocky Mountain region.[2]

Section 2. Sources of information.

The information covering all of the important phases of the investigation, which was secured from the large companies, was obtained directly from their records or was prepared by them and carefully checked by examiners of the Commission. The work was greatly facilitated through the cooperation of the officials and employees of the large companies. The information secured from the smaller companies was largely furnished by them on schedules sent out by the Commission. In some cases examiners of the Commission assisted these companies in the preparation of the schedules. The smaller companies generally responded very promptly in furnishing the Commission with the desired information regarding their operations.

The statistical and general information regarding the petroleum industry was obtained from Federal and State bureaus and departments, such as the United States Geological Survey and Bureau of Mines, the California State Mining Bureau, reports of the California State Council of Defense, from the records of the Independent Oil Producers' Agency of Los Angeles, Calif., from the bulletins of the Standard Oil Co. (California), and from oil-trade journals.

[1] The Advance in Price of Petroleum Products.
[2] The Petroleum Industry of Wyoming.

CHAPTER II.

PETROLEUM SUPPLY OF THE UNITED STATES.

Section 1. Position of the United States in the petroleum industry.

POSITION IN THE WORLD INDUSTRY.—The United States has always held a commanding position in the petroleum industry of the world. It has excelled in the development of efficient methods of producing and transporting crude petroleum, in the development of refining methods, has generally maintained the leadership in the volume of its production of crude and refined products, and its trained geologists and practical oil men have had an important part in the development of oil fields in all parts of the world. The importance of the United States as a producer of crude petroleum is shown by the statistics of the world's production. Statistics showing the production by countries have been compiled by the United States Geological Survey for the period 1857–1919 and by the American Petroleum Institute for 1920. The total production from 1857–1920 and the estimated production for 1920 for all the principal crude-petroleum producing countries and the percentages produced by each country are shown in Table 1.

TABLE 1.—*World's production of crude petroleum, by countries, in barrels of 42 gallons, 1857–1920.*

Country.	1920 [1]		1857–1920 [2]	
	Barrels.	Per cent.	Barrels.	Per cent.
United States	443,402,000	64.40	5,429,692,719	62.15
Mexico	159,800,000	23.21	532,055,489	6.09
Russia	30,000,000	4.36	1,929,497,199	22.08
Dutch East Indies	16,000,000	2.32	219,816,513	2.52
India	8,500,000	1.23	123,397,365	1.41
Roumania	7,406,318	1.08	165,428,729	1.89
Persia	6,604,734	.96	27,072,797	.31
Poland (Galicia)	6,000,000	.87	166,105,273	1.90
Peru	2,790,000	.41	29,820,387	.34
Japan	2,213,083	.32	42,886,330	.49
Trinidad	1,628,637	.24	10,902,028	.12
Egypt	1,089,213	.16	7,438,749	.09
Argentina	1,366,926	.20	6,846,019	.08
Venezuela	500,000	.07	1,242,823	.01
France (Alsace)	700,000	.10	1,044,000	.01
Canada	220,000	.03	24,886,770	.29
Germany	215,340	.03	17,113,461	.20
Italy	38,000	.01	1,046,671	.01
Algeria	.....	.....	5,000	.....
Other countries	.....	.....	1,168,067	.01
Total	688,474,251	100.00	8,737,466,389	100.00

[1] American Petroleum Institute.
[2] United States Geological Survey, 1857–1919; American Petroleum Institute, 1920.

The United States has ranked first as a producer of crude petroleum among the countries of the world each year since 1857, except during the years 1898 to 1901, when Russia was first and it was second.

Mexico ranked third each year from 1911–1917, since which time it has been the second largest producer. The importance of the United States as a producer of crude petroleum is shown by its percentage of the total production since 1857. At the end of 1920 this country had produced over 62 per cent of the total; Russia, which ranked second, produced about 22 per cent; while the Mexican production, which was the third largest for the period, was only 6 per cent of the total.

In 1920 the United States produced 64.4 per cent of the world's total production; Mexico, which ranked second, produced 23.2 per cent, while Russia, the third largest producer, supplied only 4.4 per cent of the total. The production of Russia has been greatly curtailed since the early years of the World War, and the production in Mexico was restricted for several years prior to 1920 by the unsettled political conditions in that country.

FOREIGN TRADE IN CRUDE PETROLEUM.—The quantity of net imports, that is, imports less exports, of crude petroleum into the United States shows the supply obtained from foreign sources. During recent years the United States has consumed more crude petroleum than it has produced, while at the same time its exports of refined products have been very large. The growth of our net imports of crude petroleum is shown in Table 2.

TABLE 2.—*Net imports of crude petroleum into the United States, in barrels of 42 gallons, 1913–1920.*[1]

Year.	Net imports.	Percentage of net imports to total consumption.	Year.	Net imports.	Percentage of net imports to total consumption.
	Barrels.	*Per cent.*		*Barrels.*	*Per cent.*
1913	12,345,969	4.7	1917	26,008,919	6.7
1914	13,943,227	5.3	1918	32,834,918	8.0
1915	14,371,170	5.3	1919	46,802,916	11.1
1916	16,700,963	5.2	1920	97,418,197	18.5

[1] Compiled from Monthly Summary of Foreign Commerce of the United States, Bureau of Foreign and Domestic Commerce.

Appendix Table 1 shows the quantity of exports and imports of crude petroleum as well as the net imports and percentages of net imports to total consumption for the years 1913–1920.

Prior to July 1, 1912, the quantity of crude petroleum imported into the United States was not shown separately. Up to the end of 1920 imports of crude petroleum into the United States increased about 525 per cent, exports increased 89 per cent; while the net imports increased 689 per cent. The net imports in 1913 were equal to 4.7 per cent of the total available for consumption for that year, while those for 1920 equaled 18.5 per cent. The total imports of crude petroleum for 1920 were slightly larger than the total production of the State of California for the same year, while the net imports were 1,400,000 barrels larger than the production of the State of Texas. The importation of crude petroleum into the United States became important in 1917, and since that year the increase has been very rapid.

During the period 1915–1920 Mexico furnished from 96.4 per cent to 99.9 per cent of all the crude petroleum imported into the United States; while during the same period Canada has taken from 68.9 to 89.7 per cent of the crude petroleum exported. At the present time the exports of crude petroleum to Canada are almost all shipped from the Wyoming oil fields to Regina, Saskatchewan, by tank car, or from the Illinois and Indiana fields to Sarnia, Ontario, via pipe line. The exports of crude petroleum from the Pacific coast are very small.

As already pointed out, the rapid growth in imports of crude petroleum is almost entirely due to imports from Mexico, and it is expected that such imports will continue to increase. Data prepared by the Latin-American division of the United States Bureau of Foreign and Domestic Commerce show that in 1918, 17 out of 27 crude-oil producing companies in Mexico were owned by American oil interests and that these companies produced 73 per cent of the total production of Mexico for that year. In November, 1919, there were 305 oil wells with a reported potential daily production of 1,600,000 barrels, of which 200 wells, with a potential daily production of 1,300,000 barrels, were owned and operated by American interests.[3]

A large foreign supply of crude petroleum for the United States in the near future appears to be an imperative necessity. The latest estimates of well-informed geologists place the per cent of crude oil reserves within the United States as about 16 per cent of the world's total.[4]

FOREIGN TRADE IN REFINED PRODUCTS.—As shown in Appendix Table 1, the imports of crude petroleum are increasing very rapidly and in 1920 were about twelve times as large as the exports of crude petroleum. In contrast to this situation the exports of refined petroleum products from the United States are very important, while the imports of such products are almost negligible. In 1920 the exports of refined petroleum products were twenty-five times as large as the imports of such products.

The quantity of net exports of refined products from the United States, in barrels of 42 gallons, is shown in Table 3:

TABLE 3.—*Net exports of refined petroleum products from the United States, in barrels [a] of 42 gallons, 1913–1920.[b]*

Year.	Quantity.	Year.	Quantity.
	Barrels.		*Barrels.*
1913	46,668,213	1917	58,608,029
1914	50,720,464	1918	59,371,896
1915	53,050,841	1919	53,015,750
1916	58,919,584	1920	64,463,700

[a] The quantities of paraffin wax reported in pounds have been converted to barrels on the basis of 6½ pounds to the gallon.
[b] Compiled from Monthly Summary of Foreign Commerce of the United States, Bureau of Foreign and Domestic Commerce.

The quantity of imports, exports, and net exports of refined petroleum products in the United States, in barrels of 42 gallons, is shown in Appendix Table 2 for the period 1913–1920.

The year 1913 is the first full year for which imports of refined products are shown separately. The quantity of refined petroleum

[3] Latin-American Circular No. 74, Department of Commerce.
[4] See Advance in the Price of Petroleum Products, p. 22.

products imported into the United States is very small in comparison with the quantity exported. In 1915 domestic prices of kerosene and motor gasoline were low for the greater part of the year, and as a result the imports declined greatly.

The export trade in refined petroleum products is very large and the statistics show an increase of about 42 per cent in 1920 over 1913, while the increase in the net exports was 38 per cent. The very large totals for 1916, 1917, and 1918 resulted largely from the tremendous war demand for gasoline. The total for imports, exports, and net exports were higher during 1920 than in any previous year.

IMPORTS OF CRUDE PETROLEUM AND EXPORTS OF REFINED PRODUCTS.—As already pointed out, the quantity of crude petroleum imported into the United States during 1920 was about 12 times as large as crude oil exports, while the exports of refined petroleum products for the same year were over 25 times as large as the imports. A comparison of the net imports of crude petroleum and the net exports of refined petroleum products for the period 1913–1920 is shown in Table 4:

TABLE 4. *Net imports of crude petroleum and net exports of refined products, in barrels of 42 gallons, 1913–1920.*

Year.	Net exports of refined products.	Net imports of crude petroleum.	Excess of net exports of refined products.
	Barrels.	*Barrels.*	*Barrels.*
1913	46,668,213	12,345,969	34,322,244
1914	50,720,464	13,943,227	36,777,237
1915	53,050,841	14,371,170	38,679,671
1916	58,919,584	16,700,963	42,218,621
1917	58,608,029	26,008,919	32,599,110
1918	59,371,896	32,834,918	26,536,978
1919	53,015,750	46,802,916	6,212,834
1920	64,463,700	97,418,197	[1] 32,954,497

[1] Excess of imports.

The excess of the net exports of refined petroleum products over the net imports of crude petroleum increased rapidly from 1913 to 1916, but in 1917 there was a decline, due to the large increase in the imports of crude petroleum from Mexico contemporaneously with a slight decrease in exports of refined products. This decline in net exports, which began in 1917, continued through 1920. In 1919 the net exports of refined products exceeded the net imports of crude petroleum by only 6,212,834 barrels, while in 1920 the imports of crude petroleum increased much more rapidly than the exports of refined products, and for the first time the net imports of crude petroleum exceeded the net exports of refined products, notwithstanding the fact that the net exports of refined products were much larger than for any previous year.

As shown in Appendix Tables 1 and 2, most of the exports of petroleum products from the United States are refined products. In the process of refining crude petroleum there is a considerable loss, which in 1920 averaged 4.3 per cent for the entire country. Hence the quantity of crude petroleum required to produce the quantities of refined products exported is somewhat larger than the totals shown in the above table. For example, it required 70,125,598 barrels of

crude oil to produce the 67,110,196 barrels of refined products exported in 1920.

In addition to the quantities of petroleum shown as exports, there are large quantities of fuel or bunker oil laden on vessels engaged in foreign trade. The totals reported below include fuel oil used by both American and foreign ships. The quantities of fuel oil laden on vessels engaged in foreign trade 1915–1920 are shown in Table 5.

TABLE 5.—*Fuel or bunker oil laden on vessels engaged in foreign trade, in barrels of 42 gallons, 1915–1920.*

Year.	Quantity.	Year.	Quantity.
	Barrels.		*Barrels.*
1915	3,565,805	1918	6,603,043
1916	5,529,787	1919	14,031,356
1917	5,908,319	1920	26,334,883

The total for 1920 is almost seven and one-half times as large as that for 1915. Doubtless a considerable proportion of the totals shown above were used by foreign vessels and really should be classified as export sales, so that even in 1920 the net imports of crude petroleum were not greatly in excess of the net exports of petroleum products.

PRESENT CONDITIONS OF SUPPLY AND DEMAND.—As already shown, prior to 1920 the United States has exported larger quantities of petroleum products than it has imported in the form of crude petroleum. During the period 1913–1920 the marketed production of the United States increased from 248,446,000 barrels to 443,402,000 barrels, or an increase of 78 per cent. During the same period the consumption of crude petroleum increased from 260,859,000 to 526,880,000 barrels, an increase of 102 per cent. During the first three years of the period production exceeded consumption and the quantity in storage increased, while for the three years beginning with 1917 the annual consumption was considerably larger than the production. In 1920 the domestic production and imports were much larger than in any previous year, and for the first time imports of crude slightly exceeded exports of petroleum products. As a result of this situation there was a slight increase in the quantity held in storage during 1920. Production has continued large during the early months of 1921, so that the petroleum shortage, which became acute in 1919 and the first part of 1920, seems to have been temporarily met, both on the Pacific coast and in the United States as a whole; however, the problem of an adequate petroleum supply for the future does not appear to be fully solved.

So far as the American petroleum industry is concerned, there is no doubt but that the leading factors will endeavor to extend their operations both in the United States and in foreign countries. In this connection it should be borne in mind that the United States to-day is dependent upon Mexican petroleum to meet the deficiency in its own supply, and that practically all of it comes from lands that are owned or controlled by Americans. However, in order to secure adequate concessions in foreign lands the industry needs the active support of the American Government.

Section 2. Position of California in the national petroleum industry.

PRODUCTION BY STATES.—California ranks first among all the States in the total quantity of crude petroleum produced from the beginning of the industry to the end of 1920, and it has ranked first or second in the quantity of its annual production of crude petroleum during recent years. Since the crude petroleum industry began in California that State has produced 24.3 per cent of the total production of the country, and during 1920 it produced 23.8 per cent of the country's total. The position of California with reference to the other crude petroleum producing States is shown in Appendix Table 3, which shows, by States, the total marketed production of crude petroleum, 1859–1908, and the annual production 1908–1920. The production and proportion of crude petroleum produced by States during 1920 and the total since 1859 are shown in the following table:

TABLE 6.—*Production of crude petroleum in the United States, by States, in barrels of 42 gallons, 1859–1920.*[1]

State.	1920		1859–1920	
	Barrels.	*Per cent.*	*Barrels.*	*Per cent.*
Oklahoma	105,725,000	23.8	1,041,650,267	19.2
California[2]	105,668,000	23.8	1,317,458,576	24.3
Texas	96,000,000	21.7	509,537,005	9.4
Kansas	38,501,000	8.7	218,243,488	4.0
Louisiana	35,649,000	8.0	201,993,911	3.7
Wyoming	17,071,000	3.9	70,469,573	1.3
Illinois	10,772,000	2.4	321,433,380	5.9
Kentucky and Tennessee	8,692,600	2.0	36,132,260	.7
Pennsylvania and New York	8,360,400	1.9	804,637,389	14.8
West Virginia	8,173,000	1.8	310,005,318	5.7
Ohio	7,412,000	1.7	477,867,154	8.8
Indiana	932,000	.2	107,967,464	2.0
Montana	336,000	.1	604,639	(3)
Colorado	110,000	(3)	11,579,370	.2
Miscellaneous			112,925	(3)
Total	443,402,000	100.0	5,429,692,719	100.0

[1] Compiled from statistics of U. S. Geological Survey.
[2] The Standard Oil Co. (California) shows a production of 105,721,186 barrels in 1920 and an accumulated production of 1,348,931,454 barrels (see Table 11, p. 56).
[3] Less than one-tenth of 1 per cent.

The statistics in the above table for the years prior to 1919, and also for 1920, were compiled from reports of the United States Geological Survey; while the 1919 figures are based on preliminary estimates of the Geological Survey, State reports, and trade-journal statistics. The United States Geological Survey has used the terms "production," "marketed production," and "petroleum marketed" to describe their annual statistics in different years. In their report for 1918 these terms are said to have the same meaning, and the Geological Survey states that the 1918 statistics, which were reported as crude petroleum production, included "runs to pipe lines from field sources and by shipments from wells by tank cars or wagons, including oil used for field development."[5] The data for 1920 include "the quantity of petroleum removed from producing properties." Oil consumed on leases and net changes in producers' storage are not included except for California.[6]

[5] U. S. Geological Survey, Petroleum, 1918, p. 971.
[6] U. S. Geological Survey, Preliminary Summary of Statistics of Crude Petroleum for 1920.

The States are arranged on the basis of their production in 1920. The first six States, viz, Oklahoma, California, Texas, Kansas, Louisiana, and Wyoming, produced almost 90 per cent of the total quantity of crude petroleum produced in the United States during 1920. California produced 23.8 per cent of the total production for 1920, and from the beginning of the industry to the end of 1920 it has produced 24.3 per cent of the total. In recent years the State of Oklahoma has competed with California for first place and its aggregate production is second, with 19.2 per cent of the total production from the beginning of the petroleum industry in this country to the end of 1920, and 23.8 per cent of the total production for 1920. These two States alone produced almost 48 per cent of the total quantity of crude petroleum produced in the United States for 1920. The 1920 production for several of the leading States has been greater than that for any previous year, while the production for other important States has been much larger than for 1919. The total production for the entire country, as shown by the preliminary reports of the United States Geological Survey, was about 66,000,000 barrels greater in 1920 than in 1919.

During recent years the United States has depended on the following States for the bulk of its production and for any increase in the quantity of crude-oil production, viz, California, Oklahoma, Texas, Kansas, Louisiana, Wyoming, and Kentucky. The production of California is discussed in detail in the following chapter. The following brief summary of the important developments, which have made possible the steady increase in the total production for the country during the last few years, shows the wide area in which producers of petroleum have been successful in extending old oil pools and in the development of new ones.

The State of Oklahoma became an important factor in the production of crude petroleum in 1908, in which year its production was greater than the total produced in that State for all previous years. This large increase was occasioned by the rapid development of the Glenn pool during 1907 and 1908. There was another large increase in the quantity produced beginning in 1913, resulting from the development of the Cushing pool, which was discovered in December 1912. In 1913 the production from the Cushing pool was greatly increased by deeper drilling, which struck a new oil-bearing sand and brought a flood of crude petroleum to the surface. During the period 1915–1918, and again in 1920, Oklahoma ranked first among the crude-oil producing States in volume of its annual production. Its maximum production up to the end of 1920 was reached in 1917, which was followed by a considerable decline in 1919, when it yielded leadership in the volume of production to California. In 1920, however, there was a marked increase in Oklahoma's production, and this State again became the largest producer with the production of 105,725,000 barrels, or 57,000 barrels more than that reported for California.

The State of Texas has forged to the front as a producer of crude petroleum during the past eight years. The large increase beginning in 1918 was the result of the development of the Ranger and the Burkburnett pools in northern Texas. The discovery well in the Ranger pool was completed in October, 1917, and since that time drilling operations have been very active. The maximum production from this pool was obtained in July, 1919, when the daily average production was about 73,000 barrels. During 1919 the Ranger pool

produced 22,379,665 barrels of crude petroleum. Since July, 1919, its production has declined until at the end of June, 1921, it was about 16,000 barrels per day. In 1918 the production in the Burkburnett pool was greatly increased and the largest production was obtained in August, 1919, when the daily average was about 92,000 barrels, in spite of the fact that many wells were shut in on account of the lack of facilities to enable the producers to market all of their production. The Burkburnett pool was credited with a production of 25,865,747 barrels in 1919, and together with the Ranger pool produced almost 62 per cent of the total for the entire State in that year. At the end of June, 1921, the Burkburnett pool was producing about 50,000 barrels per day. During the last half of 1920 the production of the State of Texas was greatly increased, and the production for 1920 was much larger than for any previous year, the preliminary estimates showing a total of about 96,000,000 barrels.

Compared with the year 1915, an enormous increase was made in Kansas in the three years following. This resulted from the discovery of a new prolific oil-producing pool in Butler County. Some of the new wells in this new pool had an initial capacity of 15,000 to 18,000 barrels per day. In 1918 the production for the State rose to 45,451,017 barrels, as compared with 2,823,487 barrels in 1915. In 1919 there was a sharp decline in production, but the preliminary figures for 1920 show an increase over the previous year.

The development of the Caddo pool in the northwestern part of the State of Louisiana in 1912 made this State an important factor in the production of crude petroleum. By 1915 an annual production of almost 18,200,000 barrels was recorded, while from 1916 to 1919 there was a temporary decline with the annual production fluctuating from 11,400,000 to 16,000,000. The development of the new Homer pool in Claiborne Parish in the northwestern part of the State and the new wells drilled in the Bull Bayou district in the early part of 1920 brought on an enormous flush production that added materially to the year's production. Preliminary figures for 1920 give the north Louisiana oil fields 33,896,000 barrels as compared with 13,575,000 barrels in 1919. Nearly 22,000,000 barrels of the 1920 total came from the Homer pool alone,[7] and at the end of June, 1921, its production was averaging about 36,000 barrels per day.[8] The preliminary estimates for 1920 place the Louisiana production at 35,650,000 barrels.

The production of crude petroleum in Wyoming, which is a high-grade light crude, has increased very rapidly during recent years. Its production first exceeded 1,000,000 barrels in 1912, while by 1918 it was more than 12,500,000 barrels, and during 1920 it increased to slightly more than 17,000,000 barrels.[9]

The State of Kentucky is the only State east of the Mississippi River that has increased its production to any appreciable extent in recent years. In 1915 the production of Kentucky had declined to 437,274 barrels. The discovery of new pools in the eastern part of the State in 1916 marked the beginning of extensive exploration and drilling operations in many other sections of the State, with the result that in 1919 the marketed production had increased to

[7] Oil and Gas Journal, Jan. 28, 1921, p. 16.
[8] American Petroleum Institute Bulletin 170.
[9] See Report of the Federal Trade Commission on the Petroleum Industry of Wyoming.

9,226,472 barrels.[10] This large increase not only made Kentucky the leading crude oil producing State in the Appalachian group but it also increased the production of this group, which had been declining, to practically the same quantity marketed in 1905. During 1920 the production of Kentucky and Tennessee declined from the record total of 9,226,472 barrels in 1919 to 8,692,600 barrels.

THE CALIFORNIA REFINING INDUSTRY.—On January 1, 1921, the rated daily capacity of petroleum refineries in the United States was 1,530,000 barrels of crude oil, while the refineries located in the State of California had a rated daily capacity of 310,320 barrels, or 20.27 per cent of the total refining capacity of the whole country. The crude petroleum produced east of the Rocky Mountains is practically all refined, while in California large quantities are consumed as fuel without refining. The actual refining operations as reported by the United States Bureau of Mines show the following results:

TABLE 7.—*Crude petroleum refined in California and the United States, in barrels of 42 gallons, 1916–1920.*

Year.	Total quantity refined in the United States.	Total quantity refined in California.	Percentage refined in California.
	Barrels.	*Barrels.*	*Per cent.*
1916	246,992,015	62,950,127	25.49
1917	301,319,318	72,949,725	24.21
1918	326,024,630	66,464,969	20.39
1919	361,520,153	72,933,052	20.17
1920	433,915,029	76,745,480	17.69

The California crude petroleum is a very heavy crude as compared with most of that produced east of the Rocky Mountains, and large quantities are consumed as fuel without being run through a refinery; hence the quantity refined each year is much smaller than the annual production. During 1920 there was an acute shortage of gasoline, and as a result the total quantity of crude petroleum refined in California increased about 5 per cent over 1919; at the same time the total for the entire country increased about 20 per cent. In recent years the proportion of the total production refined has increased from 68.6 per cent in 1916 to 72.6 per cent in 1920 for the State of California.

[10] Includes the marketed production of Tennessee, which is negligible.

Chapter III.

THE CALIFORNIA OIL FIELDS.

Section 1. Early development.

The petroleum pits in Brea Canyon, about 50 miles southeast of Los Angeles, which contained the bones of the saber-toothed tiger and other prehistoric animals of the Pleistocene epoch, were first discovered by sheep herders. The seepage from these deposits attracted the attention of the early inhabitants and was used as fuel and cement as early as 1856. The development of the petroleum industry in Pennsylvania, which began in 1859, led to investigations in California regarding the quality of the petroleum. Samples were obtained from seepages in Ventura County and elsewhere in 1865, and the reports based on an analysis of these samples were so favorable that drilling operations were undertaken in all parts of the State. Most of these efforts were failures, notwithstanding the fact that tests were made in several of what have since become the most productive oil regions of the State. Inexperience in drilling and primitive drilling apparatus were largely responsible for the failure to discover large petroleum deposits.

The first attempt in California to produce crude petroleum for commercial purposes was in 1864, when tunnels were run into the oil formations in Sulphur Mountain, in what is now Ventura County, and small quantities of crude petroleum were floated out on the water that came with it. The mixture was run into flumes and thence into wooden tanks. After the water settled and was withdrawn there remained a heavy grade of natural lubricating oil, which was used locally in its natural state for lubricating purposes.

The first production from oil wells in California was obtained in 1866 in the valley of the Santa Clara River in Ventura County. This district supplied nearly all the crude petroleum for the next 20 years, although some asphalt was mined in the McKittrick field in Kern County during this period. The drilling operations undertaken from 1864 to 1866 were abandoned on account of the high operating expenses and comparatively small quantities produced, and no further attempt was made to drill until 1875. This latter year may be considered the date of the first successful efforts to produce crude petroleum in commercial quantities. Late in 1875 the California Star Oil Works Co., of San Francisco, commenced drilling in Pico Canyon, Los Angeles County, about 8 miles west of the present town of Newhall. A good grade of light gravity crude petroleum was found in paying quantities at shallow depths of from 60 to 400 feet. This crude petroleum was hauled in barrels to a small refinery that was built at Lyons Station, about 9 miles from the wells. By 1878 the production of the Pico Canyon wells had increased to about 300 barrels per day.[1]

[1] Standard Oil Bulletin, May, 1913.

The total production in 1876 is given as 12,000 barrels for the entire State. Development began in the Puente Hills in the southeastern part of Los Angeles County in 1882, and in 1892 crude petroleum was discovered in the neighborhood of the city of Los Angeles, while development in the Coalinga field became active in 1896. The famous Blue Goose well in the Coalinga field and the discovery of crude petroleum in the Kern River field in 1899 speedily developed another speculative era, and as a result of intensive drilling in many counties crude petroleum was found in the Midway, Salt Lake, and Santa Maria fields and the older oil-producing areas were extended. In addition to the above districts, crude petroleum had also been found in Santa Clara, San Luis Obispo, and Monterey Counties.

Section 2. Producing area.

PROVEN ACREAGE.—There is apparently no close agreement as to what constitutes proven acreage in the California oil fields. For example, the Standard Oil Co. (California) in forwarding its statement to the Commission called attention to the fact that their statistics for proven acreage for the entire State of California for 1917 showed a total of 88,745 acres, while estimates by others ran as high as 110,000 acres. For the year 1917 the Standard Oil Co. in its reports gave the proven area of the Midway-Sunset field as 40,204 acres, while the committee on petroleum of the California State Council of Defense reported the area of these fields as about 56,500 acres. This latter estimate is apparently a high one, for in reporting the detailed estimates for this field they credit naval reserve No. 2, which is located in the Midway field, with 18,240 acres of proven territory, while the Navy Department places its proven area at 15,500 acres. The statistics compiled by the Standard Oil Co. are the only ones available giving the proven acreage of different fields. The California State Mining Bureau publishes annual statistics showing the proven acreage of oil lands in California by counties, but it does not give this acreage by fields. The total proven acreage for the entire State as reported by these two authorities are in substantial agreement. For example, in 1919 the State Mining Bureau gave the total proven area of the State as 91,792 acres, as compared with 92,087 acres reported by the Standard Oil Co.

The proven acreage of oil lands in California, the number of producing wells at the end of each year, the number of acres per well, and the quantity in barrels per acre, by fields, for the period 1914–1920, as reported by the Standard Oil Co. (California), are shown in Appendix Table 4. The total proven area for the State of California has increased from 81,365 on December 31, 1914, to 93,837 acres at the end of 1920. This represents an increase of about 15 per cent. During the same period the number of producing wells increased from 6,106 to 9,621, which is an increase of almost 56 per cent. The larger increase in the number of producing wells than in the proven acreage caused a decrease in the number of acres per well from 13.3 acres in 1914 to 9.8 acres at the end of 1920. The quantity of crude petroleum produced from each acre of the proven oil lands decreased from 1,274 barrels in 1914 to 1,127 barrels in 1920.

There is a wide variation in the number of acres per well and in the quantity produced per acre for the different fields, and also a marked change for certain fields during the period 1914–1920. In 1914 there were only 2.3 acres per well in the Summerland field as compared with 33.6 in the Santa Maria field; while in this same year the Ventura County and Newhall fields produced only 233 barrels per acre, as compared with 4,156 barrels for the Whittier-Fullerton field. By 1920 all of the fields had been more intensively developed and the number of acres per well ranged from 1.6 acres in the Summerland to 20.6 in the Santa Maria field, while the quantity produced per acre ranged from 239 barrels in the Summerland field to 4,497 barrels in the Whittier-Fullerton field.[2]

The statistics for the individual fields disclose some very interesting information. For example, the Ventura County-Newhall fields, which were the first oil fields developed in California, show an increase in the quantity produced per acre during the period from 233 barrels in 1914 to 425 barrels in 1920; the Kern River field shows an increase from 919 barrels per acre to 947 barrels; the Coalinga field, which is one of the oldest fields in the State, shows a decline from 1,106 barrels to 1,027 barrels per acre; while the Whittier-Fullerton field shows an increase from 4,156 barrels in 1914 to 4,497 barrels in 1920. (See p. 223.)

CONTROL OF OIL LANDS.—The necessity of ascertaining the facts regarding the degree of concentration and control of the oil lands of California by the large oil companies was recognized as of vital importance; hence the Commission requested the crude petroleum producing companies to furnish pertinent information thereon. The companies were asked to furnish information showing the acreage of producing and nonproducing lands held either in fee or under lease. Reports were obtained from 158 companies for the year ending December 31, 1918, but owing to difference of opinion as to what constituted producing property, the only data that was considered reliable was that showing the total acreage of oil land owned or leased by the companies reporting. Twenty-seven [3] of the 158 companies reporting were either owned or controlled by the seven large producing interests. The holdings of the large producing interests are shown separately in Table 8, which gives the acreage of land owned in fee, the acreage leased, and the percentage owned or leased by each group.

TABLE 8.—*Acreage of oil land reported by 158 companies, acreage and proportion owned or leased by seven large interests controlling 27 companies, Dec. 31, 1918.*

Owner.	Land owned in fee.		Land leased.		Total.	
	Acres.	Percentage.	Acres.	Percentage.	Acres.	Percentage.
Large producing interests	255,507	79.84	179,077	92.25	434,584	84.53
Other producers	64,517	20.16	15,035	7.75	79,552	15.47
Total	320,024	100.00	194,112	100.00	514,136	100.00

[2] Certain miscellaneous fields which had not proven to be important factors show a larger acreage per well and a smaller production per acre in both years.
[3] This number was increased to 29 in 1919.

These seven interests, named according to the size of their oil-land holdings as of December 31, 1919, are: The Union Oil Co. of California, the Standard Oil Co. (California), the Associated Oil Co.-Southern Pacific interests,[4] the Doheny companies, the General Petroleum Corporation, the Santa Fe Railway Co., and the Shell Co. of California. These interests owned 79.84 per cent of all the acreage reported by the 158 companies as owned in fee, and they controlled 92.25 per cent of the land held under lease, while their total holdings were 84.53 per cent of the total reported.

Data showing the total acreage of oil land owned in fee or held under lease were secured from the large producing interests for the year ending December 31, 1919. In addition, the acreage of proven oil land as reported by the California State Mining Bureau for these large interests and for all other crude petroleum producers was secured as of March 1, 1920. Table 9 shows the total acreage as reported by the seven large crude-oil producing interests, their proven acreage and the percentage of the total proven acreage owned by each of the large producing interests and that owned by other producers.

TABLE 9.—*Acreage of oil lands and acreage of proven oil lands held by the seven large interests, and the acreage of proven lands held by other producers.*

Interest.	Total oil lands Dec. 31, 1919.	Proven oil lands Mar. 1, 1920.	
		Acres.	Per cent.
	Acres.		
Union Oil Co. of California	286,417	9,184	10.0
Associated Oil Co.-Southern Pacific interests [a]	154,112	28,055	30.6
Standard Oil Co. (California)	95,413	10,017	10.9
Doheny Companies	30,332	4,761	5.2
General Petroleum Corporation	20,443	3,559	3.9
Santa Fe Railway Co.	15,970	4,043	4.4
Shell Co. of California	9,474	2,893	3.1
Total seven large interests	612,161	62,512	68.1
Other producers	.....	29,280	31.9
Total	.....	91,792	100.0

[a] Southern Pacific lands and control of Associated Oil Co. taken over by the Pacific Oil Co., Dec. 3, 1920.

The seven large producing interests shown above controlled on March 1, 1920, 68.1 per cent of the total proven area of the State of California, and in addition held a very large acreage which has not yet been proven or developed. At the end of 1919 the combined holdings of the same group of large producing interests had increased by 177,577 acres, or 40.9 per cent over their 1918 holdings, and their total acreage for 1919 exceeded the total reported by the 158 companies for 1918 by 98,025 acres.

Section 3. Main divisions of oil fields.

The California oil fields lie in the southern half of the State, and, with respect to their geographic location, are grouped in three main divisions, namely, the San Joaquin Valley, the Coastal, and the

[4] The Southern Pacific Co. controlled the Associated Oil Co. in 1919; in December, 1920, the Southern Pacific oil lands and control of the Associated were taken over by the Pacific Oil Co.

Southern. Each division includes a number of producing fields, the location of which is shown on the map opposite.

SAN JOAQUIN VALLEY DIVISION.—The San Joaquin Valley Division is located in the San Joaquin Valley. All of the oil fields which are included in this division lie in Fresno, Kings, and Kern Counties. At the present time almost 80 per cent of all the crude petroleum produced in the State of California is obtained from the San Joaquin Valley Division. This division includes the following important fields—named in the order of their production in 1920—Midway-Sunset, Coalinga, Kern River, Lost Hills-Belridge, and McKittrick. During 1920 the Elk Hills pool was developed.

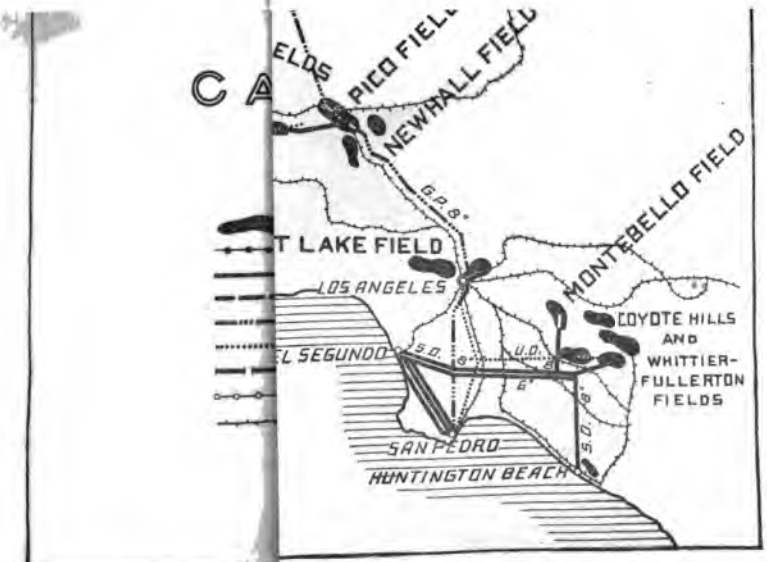
The Midway-Sunset field is the most prolific oil-producing territory thus far developed in the State of California. This field lies in the southwestern part of Kern County and is about 30 miles southwest of the city of Bakersfield. This area really includes two fields, the Sunset and the Midway. The Sunset portion of the field was developed earliest, the first well being drilled in 1891, but its production did not become commercially important until 1900, when 12,500 barrels were produced. The maximum production was in 1914, when 12,546,615 barrels were produced. The Sunset field has an area of about 15 square miles. The wells vary in depth from 500 to 3,000 feet and the gravity of the crude varies from 11° to 26° Baumé.

The Midway field is the most prolific field thus far developed in California and is one of the most productive in the United States. The total area of the field is approximately 75 square miles. Development in this field began in 1900, and in 1914 the largest annual production of 37,479,228 barrels was recorded. The depth of the wells ranges from 400 feet to about 4,300 feet and the gravity varies from 13° to about 30° Baumé. The oil sands in the Midway-Sunset fields vary from 65 to 175 feet in thickness.

The Coalinga field is the second largest producing field in the San Joaquin Valley and the third most productive field in the whole State of California. This field is located in the southwestern part of Fresno and the northwestern part of Kings County, and it marks the northern limits of the present development of crude petroleum production in the State of California. The first successful well was drilled in 1890 and the maximum production of the field was reached in 1912, when 19,546,122 barrels were produced. Since 1912 the production has declined somewhat, but it is still important.

There is a very great range in the depth of the wells in this field. The shallower wells are only about 300 feet deep, while the deepest wells have reached a maximum of 4,700 feet. The oil sands vary from 10 to 450 feet in thickness, with an average of about 140 feet. The crude petroleum produced in this field varies greatly in the quality as indicated by a range of from 12.4° to 35.5° Baumé. Approximately 60 per cent of the production of this field is light crude.

The Kern River field is located in the central part of Kern County and lies in the low rolling hills at the foot of the Sierra Nevada Range on the eastern rim of the San Joaquin Valley, and is about 35 miles northeast of the Midway-Sunset fields. The Kern River field is the fourth most productive field in the entire State. The development of the Midway-Sunset fields and the Kern River field marked the beginning of California as an important factor in the world's produc-



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tion of petroleum. The area of this field is over 12 square miles, and it has a proven area of 7,876 acres. The first well in this field was drilled in June, 1899, and its maximum production was reached in 1904, when 17,226,240 barrels were produced.

The depth of the wells in the Kern River field varies from 400 feet to more than 2,500 feet, with an average of approximately 900 feet. The oil-producing sands range in thickness from 200 to 500 feet, the average being about 300 feet. The crude petroleum produced in this field is very heavy, ranging from 10.4° to 17° Baumé, and is used mainly for fuel oil and in the manufacture of asphalt.

The McKittrick field is located in the western part of Kern County and lies between the Belridge field and the Midway-Sunset fields. It is a small field having an area of approximately 4 square miles with a proven area of about 1,670 acres. The first development of this field began about 1866, at which time operations were confined largely to the manufacture of asphalt. The first successful oil well was drilled in 1892, but the field did not assume great importance until 1898. The maximum production of 5,807,360 barrels was reached in 1909. The depth of the wells in the McKittrick field varies from about 400 feet to 3,982 feet. The crude is comparatively heavy, ranging from 12° to 24° Baumé.

The Lost Hills field is about 50 miles southeast of the Coalinga field, and is located in the western part of Kern County. The first well of importance was drilled in 1910, and since that time the field has been extended to a length of approximately 6 miles, with a width of from about 2,000 to 4,000 feet. The wells range in depth from 500 feet to 2,388 feet. Most of the crude petroleum production in this field is a light crude, the gravity ranging from 15° to as high as 38° Baumé. The production of the Lost Hills field has been combined with that of Belridge.

The Belridge field is located in Kern County and lies about midway between the Lost Hills and the McKittrick fields. In shape it is similar to the Lost Hills, having a width of from one-fourth to one-half mile and a length of about 3 miles. Its proven oil area and that of the Lost Hills field combined aggregates 5,026 acres, and the largest combined production of these two fields was in 1917, when 6,295,329 barrels were produced.

There is a great variation in the depth of the wells in the Belridge field. In the upper portion of the field they are very shallow, varying from 600 to 900 feet, while in the lower part some of the wells reach a depth of 4,000 feet. The quality of the crude petroleum in this field is similar to that produced in the Lost Hills field. About 68 per cent of the combined production of the two fields is classed as light crude.

An important pool was added to the San Joaquin Valley fields during 1920, when the Standard Oil Co. (California) and the Southern Pacific Co. developed important production in the Elk Hills pool. This field lies in the southwest part of Kern County, about 10 miles northeast of the town of Taft. The discovery well was brought in by the Standard Oil Co. February 12, 1920, on land which the company had owned for a number of years. The discovery well, which was a gusher, began producing about 3,000 barrels per day, which was soon increased to 6,000 barrels, and the latter rate was maintained throughout the larger part of 1920. Subsequent

to February 12, 1920, other wells were brought in by the Standard Oil Co. and also by the Southern Pacific Co. All of the wells drilled in this new pool during 1920 were gushers, and their initial production varied from 3,000 to 6,000 barrels per day. The production obtained from this new pool has contributed largely to the increase in the production for 1920 as compared with recent years, and to the State's record daily production of 339,000 barrels, which was attained during April, 1921.

COASTAL DIVISION.—The Coastal Division[1] includes the oil fields located in the counties of San Luis Obispo, Santa Barbara, and Ventura, which are situated along the California coast. In point of production this division ranks third, and its principal fields, in the order of the importance of their production, are the Santa Maria, Summerland, and Ventura County fields.

The Santa Maria field is located in the northern part of Santa Barbara County between the Santa Ynez and San Rafael Mountains. This field includes four smaller fields or pools, namely, the Cat Canyon, the Orcutt, the Casmalia, and the Lompoc. The Cat Canyon pool is an extension of the Santa Maria field to the east, while the Casmalia pool is an extension to the westward. The first successful well in the Santa Maria field was completed in August, 1901, in the Orcutt pool. The Lompoc pool was discovered in 1906 and lies between the other pools and the Pacific Ocean. In 1908 the first well was completed in the Cat Canyon pool, while the Casmalia extension was brought in during 1917. The proven area of the Santa Maria field is about 8,360 acres, and its maximum production was reached in 1908, when 8,699,350 barrels were produced.

The wells in these fields are comparatively deep. In the Orcutt pool they range from 2,000 feet to 4,000 feet; in the Cat Canyon, 2,400 feet to 3,200 feet; and in the Lompoc 2,500 feet to 4,400 feet in depth. There is a considerable range in the gravity of the crude. The crude petroleum produced in the Orcutt pool is comparatively light, the gravity ranging from 20° to 35° Baumé. The Cat Canyon crude petroleum is much heavier, ranging from 9° to 19° Baumé, while in the Lompoc pool the range is from 16° to 37° Baumé.

The Summerland field is situated on the shore of the Pacific Ocean, about 40 miles below the Santa Maria field and about 6 miles southeast of the city of Santa Barbara. This field is unique among the oil fields of the United States in that its production is largely secured from wells drilled in the Pacific Ocean, many having been drilled farther out than low tide. The field is very small, the proven area including only 230 acres. The first well was drilled in 1891, and the maximum production of only 208,370 barrels was recorded in 1899. The depth of the wells ranges from 80 feet to 600 feet. The crude petroleum produced in this field is very heavy, the gravity varying from 9° to 18° Baumé, with an average of about 14°. This crude is very viscous and is used principally for road dressing and for fuel oil.

The Ventura County fields consist of numerous small separated fields, or pools, which lie in the valley of the Santa Clara River. The Santa Clara River practically parallels the coast line for a distance of about 50 miles in an easterly direction from the Ojai Valley in Ventura County to the Newhall field in northern Los Angeles

[1] See Report of Committee on Petroleum, California State Council of Defense.

County. In Ventura County the wells on the north side of the Santa Clara River are largely situated in canyons among the very rough foothills of the San Rafael Mountains. The elevation of these hills varies from 1,200 to 2,800 feet above sea level, and many of the leases are accessible only with difficulty. The wells on the south side of the river are located far down the slope of the hills. The wells in the Newhall district are situated in several canyons in the higher part of the San Fernando Mountains. The elevation of the mountains in this region ranges from 1,300 to 1,700 feet above sea level. The principal production is obtained from Pico Canyon, Wiley Canyon, and Elsmere Canyon.

The Ventura County fields include the oldest oil-producing pools in California. The first oil wells were drilled in Ventura County in 1865, and in 1866 more than 3,000 barrels were produced, and prior to 1880 practically all of the crude petroleum produced in the State came from this group of pools. The commercial development in the Newhall field began in 1875, when three wells were drilled in the Pico Canyon, and in 1880 a production of 40,600 barrels was recorded. This entire territory has been characterized by great stability of production, and, contrary to the usual experience in other oil-producing sections, this pioneer district in California recorded a larger production in 1920 than for any preceding year, notwithstanding the fact that crude in commercial quantities has been produced in these fields for about 45 years. Some of the wells are still producing as much crude petroleum as they did when first brought in over 20 years ago.

There is a great difference in the depths of the wells in different parts of these fields. Some of the wells are only 200 feet deep, while others are drilled to a depth of 3,700 feet; the majority of the wells, however, are less than 1,000 feet deep. The crude petroleum varies greatly in gravity, ranging from 12° to 54° Baumé in the Ventura County fields and from 11° to 39° in the Newhall field. About 90 per cent of the total production is higher than 18° Baumé gravity.

SOUTHERN DIVISION.—The oil pools in the Southern Division are located in Orange and Los Angeles Counties. This group includes the Salt Lake, Los Angeles City, Montebello, Coyote Hills, Whittier-Fullerton, Richfield and Huntington Beach pools.

The Salt Lake field lies just west of the Los Angeles city limits and is situated on gentle slopes about 2 miles south of the base of the Santa Monica Mountains. The first well was drilled in this field in 1901, and the maximum production of 4,535,800 barrels was recorded in 1908. The crude petroleum produced in this field ranges from 10° to 25° Baumé. The Salt Lake field is quite small. Its area is about 2 square miles, with a proven acreage of about 1,200 acres. The wells range from 800 to 3,000 feet in depth, with an average of about 1,725 feet.

The Los Angeles City field is situated in a thickly settled residential district of Los Angeles. Although the presence of oil and gas in the Los Angeles field was known as early as 1865, the field was not developed until 1892, when E. L. Doheny drilled in a well by hand and obtained a small but steady production. The crude petroleum is quite heavy, having a gravity of from 12° to 19° Baumé. On account of the heavy character of the crude it is used locally for

fuel purposes. During recent years production statistics for the Salt Lake pool and the Los Angeles City field have been combined. The maximum production of these two fields was 5,138,959 barrels in 1908. The combined proven acreage in 1920 was 2,700 acres. The wells vary in depth from 500 to 1,200 feet.

The Whittier-Fullerton field is located in the eastern part of Los Angeles County and in the northwestern part of Orange County. This field includes the following pools, listed in the order of their present productivity: Coyote Hills, La Habra, Brea Canyon (Fullerton), Olinda, Whittier, Montebello, Richfield, and Puente. The entire field covers an area of 15 square miles and has a proven area of about 6,381 acres. The wells vary greatly in depth in the different fields. The first important production in these fields was obtained in 1897, when a total of 12,000 barrels was produced. Since 1897 the production has steadily increased until 28,694,163 barrels were produced in 1920.

The shallowest wells are found in the Puente pool, where the depth ranges from 700 to 2,300 feet, while the deepest wells are in the Coyote Hills, where the depth ranges from 3,500 to 5,000 feet. The crude petroleum varies greatly in quality; the heaviest is 14° or 15° Baumé and the lightest exceeds 35° Baumé. The crudes obtained in the Coyote Hills, Huntington Beach, and Brea Canyon are the lightest produced in this district. The Huntington Beach field was not discovered until August, 1920.

Section 4. Development of production.

DRILLING OPERATIONS.—In order to increase or maintain the level of crude-petroleum production, it is necessary to maintain active drilling operations. The very rapid increase in the demand for many petroleum products, particularly in 1919 and 1920, made it difficult for the petroleum industry of California to secure a sufficient supply of crude petroleum. Up to 1919 the petroleum industry had been so successful in developing new oil fields and in extending old ones that the rapid increase in the demand for petroleum products had not created any general anxiety as to the adequacy of the future supply. During this period, notwithstanding increasing costs, drilling operations were active in all developed fields. This activity is shown by the record of drilling operations. Reliable drilling data are not available prior to 1907. A summary of drilling operations in California and for the United States as a whole from 1907 to 1919 is given in Appendix Table 5.

The statistics for the period 1907–1918 were obtained from the United States Geological Survey sources, while those for the year 1919 were compiled from reports obtained by the Commission. The significant figures in the table, so far as the production of crude petroleum is concerned, are the number of oil wells secured, while the combined number of oil and gas wells give the total successful operations. The dry wells, or in the language of the oil fields the "dry holes," represent the failures. The total for oil and gas wells and "dry holes" represent the efforts of the oil industry to maintain or increase the supply of crude petroleum. The number of gas wells includes only those struck in drilling for crude petroleum and represents but a small proportion of the total gas wells drilled in any given year.

The number of wells drilled in the United States increased about 49 per cent from 1907 to 1919, while the increase for the State of California during this same period was over 96 per cent. The greatest number of wells drilled in the United States subsequent to 1907 was in the year 1919, while for the State of California the greatest number was drilled in 1911. The total number of wells drilled in the United States declined almost 30 per cent from 1907 to 1911, which year records the lowest total during the period. The decrease during this period was the result of the rapid development of production in the Illinois field, which became important in 1907. The quantity of crude petroleum produced in the Illinois field during this period congested the storage facilities and markets east of the Mississippi River, and as a result of this large increase in storage, the price of crude petroleum was reduced. This reduction in price resulted in a curtailing of drilling operations. The number of wells drilled in the oil fields east of the Mississippi River decreased from 12,859 in 1909 to 7,023 in 1911, which represented a decrease of 45 per cent in this territory. Drilling operations outside of California increased rapidly during 1912 and 1913 and they continued large throughout 1914, but there was a very sharp decline during 1915. This decline was due to the tremendous quantity of crude petroleum that was brought to the surface by the forced development of the Cushing pool in Oklahoma. As a result of this large production there was a reduction in the price of crude petroleum in all of the fields east of the Rocky Mountains. Notwithstanding the fact that there was a big decrease in the drilling operations in the entire country in 1915, the production of crude petroleum for the country outside of California did not decline. Under the pressure of war necessities and the inducement of higher prices, there was a marked increase in drilling activities east of the Rocky Mountains during 1916, but in 1917 there was a slight falling off compared to 1916, though the total was still large, while in 1918 and 1919 drilling operations were larger than ever before.

In California the period from 1907 to 1911 was one of very active drilling operations. While the year 1911 was the low year for the entire country, in California it represents the year of greatest drilling activities. The increase in the number of wells drilled in California from 1907 to 1911 was 50 per cent. From 1907 to 1914 the quantity of crude petroleum produced in California constantly increased and, although there was a sharp reduction in the number of wells drilled each year from 1911 to 1915, the drilling activities were sufficient to maintain a steady increase in production. The number of wells drilled in 1915 was only slightly more than half as great as the number completed in 1914. This curtailment in drilling was largely due to the temporary overproduction resulting from the record production of 1914, which was accompanied by a decline in consumption that followed the outbreak of the World War. This overproduction was followed by a reduction in the price of crude petroleum; and the reduction in price was immediately reflected in drilling operations, which during 1915 decreased to 300, the smallest number in the entire period. From 1916 to 1919, inclusive, prices at the well were advanced, and excepting 1919, the number of wells drilled were increased from year to year. In 1919 there was a slight falling off in the number of drilling operations.

The percentage of successful oil wells drilled in California has been remarkably large. In 1907 about 96 per cent of all the wells drilled in that State produced crude petroleum, while for the United States only 79 per cent struck oil. While there has been some fluctuation from year to year in successful operations, there was only one year in California, namely, 1911, in which less than 90 per cent of the operations brought in producing wells, and during the 13-year period 92 per cent of the total drilling operations were successful, while for the country as a whole only 73 per cent developed oil wells. As compared with other oil fields, drilling operations from 1907 to 1919 appear to indicate that there is less hazard in drilling wells in California than in other parts of the country.

HAZARD IN DRILLING.—The element of hazard is always present in drilling operations; even in proven territory where good producing wells have been secured, some drilling operations will usually fail to strike crude petroleum. In operations outside of proven territory and in new fields the percentage of failures is often very large. The hazard incident to pioneer operations in unproven territory is considered so great that such operations are described as "wildcatting."

Wildcat operations are frequently an important factor in the discovery of a new oil field. The large producers of crude petroleum in exploring prospective oil-producing areas make use of skilled geologists, and thus reduce the element of hazard in the attempt to locate new oil fields, but a considerable proportion of new oil pools have been discovered by small operators who, as a rule, do not have sufficient capital to have a careful examination made by trained geologists. The annual loss due to the failure of wildcat operations is very large, as large numbers of producers pursue such operations until their losses exhaust their financial resources. Many companies are organized each year who finance their operations from proceeds obtained from the sale of oil stocks and never succeed in drilling a producing well.

The dry holes drilled in proven and unproven territory do not include all of the risk involved in drilling operations. Many wells have to be abandoned because of mechanical difficulties and for other causes before they are drilled deep enough to reach the oil-bearing sand, but complete statistics are not available covering the number of wells abandoned before a thorough test is made. The records of one of the large companies in California illustrate the importance of such failures. Its records show that 10.65 per cent of the wells drilled proved to be dry holes and 9.76 per cent had to be abandoned for other reasons. Fifty-three of the total number of wells drilled were wildcat operations; 37 of these proved to be dry holes, 8 were abandoned because of drilling difficulties, and the remaining 8 produced crude petroleum. A few of these successful wildcat operations have resulted in the discovery of some of the best oil pools in the State of California. For example, on February 24, 1917, the Montebello Pool, and again in February, 1920, the Elk Hills Pool, were discovered through wildcat operations.

DRILLING BY COMPANIES.—A large percentage of the wells drilled in California during the period 1914–1919 were drilled by large companies. Reports were obtained by the Commission from 88 producing companies which give detailed information regarding their drilling operations for that period. The total number of wells

drilled in California and the number and percentage drilled by each group, 1914–1918, is shown in Appendix Table 6.

Some of the companies drilled wells each year, while others drilled in only one or two years during the period 1914–1918. In 1917, the year in which the largest number were reported, 64 of the 88 companies engaged in drilling. Companies producing 1,000,000 barrels or over each year drilled from 63 to 78.9 per cent of the total oil wells reported, companies producing from 250,000 to 1,000,000 barrels annually drilled from 7.5 to 23.2 per cent of the total, those producing from 50,000 to 250,000 barrels drilled from 7.7 per cent to 13 per cent of the total reported, while companies having a small annual production drilled from 1.8 per cent to 5.9 per cent of the total. During the period 1914–1918 the number of oil wells drilled by companies furnishing this information constituted from 42 per cent to 75 per cent of the total number drilled in the State.

As stated above, the large companies drilled by far the largest number of wells; however, the percentage drilled by them was no larger than should be expected from the size of their holdings. While they drilled 72.2 per cent of the total number of wells drilled in 1918, they owned 84.5 per cent of the oil lands, 68.1 per cent of the proven oil lands, and had 76.9 per cent of the net investment in the crude petroleum producing business.

So far as the smaller producing companies are concerned, if the reports received by the Commission are typical, this class has not increased its activity in drilling. Various reasons, such as lack of capital, increasing cost of drilling, and in 1915 the low price of crude petroleum at the wells, have been frequently mentioned as discouraging this class of producers from engaging in active drilling.

MEASURES GOVERNING DRILLING AND OPERATION.—Prior to 1915 there was no State regulation governing the drilling and operation of oil and gas wells in California, but by the act of June 10, 1915,[5] provision was made for the appointment of a State oil and gas supervisor, with authority to supervise the drilling, operation, maintenance, and abandonment of oil and gas wells in California, and to prevent, as far as possible, waste of crude petroleum and gas and damage to oil and gas deposits from the infiltration of water and other causes. Under this statute individuals or corporations must file an information notice with the supervisor prior to the beginning of drilling operations. Water encountered in drilling operations must be carefully shut off, under the supervision of the supervisor or one of his deputies, and wells can not be abandoned unless provision has been made for measures which have been approved by the supervisor to prevent injury to the oil and gas deposits. In 1917 the California Legislature passed an amendment to the act creating a department of the State mining bureau for the conservation of petroleum and gas resources, which increases and strengthens the jurisdiction of the oil and gas supervisor.[6]

A great improvement in oil-field conditions has resulted from the administration of these State laws. A detailed record of every important phase of drilling and operating results is kept, the geological conditions are carefully studied, and the oil and gas producers

[5] Chap. 718, California Statutes, 1915, p. 1404.
[6] Chap. 759, California Statutes, 1917.

have the benefit of recommendations and suggestions of an engineering staff whose State-wide observations enable them to give the best scientific and technical information regarding drilling, operating, and maintaining of oil and gas wells.

Section 5. Production of crude petroleum.

CHARACTER OF CALIFORNIA CRUDE.—The California crude petroleum, with the exception of certain small quantities produced in the Ventura County fields, is asphaltic in character. The California crude of asphaltic base sometimes contains more than 50 per cent of hydrocarbons belonging to the naphthene series and also contains large proportions of hydrocarbons known as the aromatic of benzol series, which are usually found in coal tar. In the early development of refining in California this comparatively large proportion of carbon to hydrogen present in the benzol series produced a kerosene which burned with a smoky flame. Later it was found that these aromatic hydrocarbons could be removed by treating the refined oil with fuming sulphuric acid.[7] The physical properties of the crude petroleum produced in the important California fields are shown in Appendix Table 7.

The temperature at which the specific gravity and Baumé scale are compared, i. e., 15° centigrade and 60° Fahrenheit, represent almost identical temperatures, 60° Fahrenheit being equivalent to 15.6° centigrade. The character of a crude is roughly indicated by the degrees Baumé, the heavy crudes being indicated by the lower degrees and the light oils by the higher degrees. The table referred to above includes neither the heaviest nor the lightest crudes. The crude petroleum produced in some of the fields ranges as low as 8° Baumé, which represents a specific gravity of 1.014, and is heavier than water. On the other hand, some of the light crude is as high as 44° Baumé (specific gravity = 0.8046), or even higher.

As already stated, the average crude petroleum produced in California is heavier than the greater part of the crude produced east of the Rocky Mountains. It yields a higher percentage of fuel oil and has a much smaller yield of kerosene and gasoline than most of the crudes produced east of the Rocky Mountains. The California industry divides the crude petroleum production into two classes, viz, light crude and heavy crude. At the present time the dividing line between the light and heavy crude petroleum is fixed at 17.9° Baumé; i. e., all crude lighter than 17.9° Baumé is classed as light crude, while the heavy grade includes all crude 17.9° Baumé or heavier. In general, the heavy crude varies from about 9° to 17.9° Baumé, while the bulk of the light crude varies from 18° to about 40° Baumé, although a very small quantity testing as high as 54° Baumé has been produced. There has been a marked increase in the proportion of light crude petroleum produced in the 13-year period 1907–1919, as shown in the table below, which is based upon information furnished by the Standard Oil Co. (California).

[7] See Report of Committee on Petroleum, California State Council of Defense, pp. 96–97.

TABLE 10.—*Proportion of light and heavy crude petroleum produced in California, 1907–1920.*

Year.	Light crude (18° Baumé and over).	Heavy crude (17.9° Baumé and under).	Year.	Light crude (18° Baumé and over).	Heavy crude (17.9° Baumé and under).
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
1907	34	66	1914	69	31
1908	36	64	1915	65	35
1909	36	64	1916	65	35
1910	45	55	1917	66	34
1911	47	53	1918	67	33
1912	54	46	1919	68	32
1913	63	37	1920[1]	70	30

[1] Estimated.

In Appendix Table 8 both the quantities in barrels of 42 gallons and the proportion of light and heavy crude petroleum produced are shown by years, 1907–1919. In 1920 the proportion of light crude has probably increased to 70 per cent.

In explaining the significance of its figures and the plan followed in determining the two classes of crudes, the Standard Oil Co. (California) submitted the following statement:

> The figures submitted are not based upon the gravity of individual wells but upon the average gravity of properties. In other words, a producer operating 20 wells may have 10 wells producing oil of less than 18° gravity, the remaining wells producing oil of a gravity sufficiently high to bring the average gravity of the production of the property to over 18° gravity. Inasmuch as we do not have records of the gravity of individual wells, the classification as stated is based upon the average gravity of properties.

It will be noted that a most pronounced change occurred as between 1910 and 1914. This was due in part to a decline of more than 7,000,000 barrels in the production of heavy crude petroleum in the Kern River field, but by far the greatest factor was the enormous increase in the production of lighter crudes in the Midway-Sunset and Whittier-Fullerton fields. In those fields alone the total production in 1914 amounted to 64,156,000 barrels, compared with 34,224,000 barrels in 1911. More than 80 per cent of this increase was in the lighter grades.

On the Pacific coast the crude used for fuel oil is sold on the market at the same price as residuum fuel oil that comes from the refinery. The practice generally is to deliver the fuel crude directly from the field to the consumer without having it pass through a refinery. In other sections of the country all crude petroleum is run through a refinery, and heretofore the residuum fuel oil has sold at prices generally ranging below the price of crude. The Standard Oil Co. (California) is an exception to the rule, as it sells no crude petroleum as fuel until it has passed through a distillation process. Under this policy of conservation the lubricating stocks and other valuable contents in the crude are saved, leaving only the residuum to be used for fuel.

PRODUCTION BY FIELDS.—The first production of petroleum in the State of California was obtained from the Ventura County fields in 1866, when 3,000 barrels were produced. During the period 1867–1874 there is no record of annual production by fields, but practically

the entire production was secured from the Ventura County fields. The statistics of the Standard Oil Co. (California) give the production of crude petroleum by fields since 1875, and they constitute the most complete record for the State of California. For a greater part of the period from 1875 to 1920 the statistics of this company covering the annual production are accepted and used as the official figures. In some cases in recent years there is some slight difference between the statistics of the Standard Oil Co. (California) and those published by the California State Mining Bureau, or by the Independent Oil Producers' Agency, or by the United States Geological Survey.

The quantity of crude petroleum produced in barrels of 42 gallons in the principal oil fields is given in Appendix Table 9, which shows the annual production for the different fields, or districts, covering varying periods of time from 11 to 45 years. The total production by fields for the entire recorded period 1866–1920, together with the production by fields for the year 1920, is shown in the following table:

TABLE 11.—*Production of crude petroleum in California, by fields, in barrels of 42 gallons, 1866–1920.*

Field.	Production.			
	1920		1866–1920	
	Barrels.	*Per cent.*	*Barrels.*	*Per cent.*
Midway	32,493,229	30.7	313,415,356	23.2
Whittier-Fullerton	28,694,163	27.2	197,839,564	14.7
Coalinga	15,464,198	14.6	245,005,605	18.2
Kern River	7,456,515	7.1	221,586,265	16.4
Santa Maria	5,928,060	5.6	100,016,181	7.4
Sunset	5,423,781	5.1	82,376,693	6.1
Lost Hills-Belridge	4,139,767	3.9	42,540,722	3.1
McKittrick	2,607,240	2.5	60,583,476	4.5
Ventura County-Newhall	2,122,449	2.0	25,226,177	1.9
Los Angeles-Salt Lake	1,311,264	1.2	56,952,791	4.2
Summerland	54,910	.1	2,343,537	.2
Miscellaneous	25,610	(1)	1,045,087	.1
Total[2]	105,721,186	100.0	1,348,931,454	100.0

[1] Less than one-tenth of 1 per cent.
[2] These totals differ slightly from those in Table 6, which are United States Geological Survey statistics.

The above table shows that of the total production of 105,721,186 barrels of crude petroleum in all California fields for the year 1920, 76,651,590 barrels, or 72.5 per cent of the total, was produced in the Midway, Whittier-Fullerton and Coalinga fields. Of this 72.5 per cent, 30.7 per cent was produced in the Midway field, 27.2 per cent in the Whittier-Fullerton field, and 14.6 per cent in the Coalinga field. For the period 1859–1920 these same fields produced, respectively, 23.2 per cent, 14.7 per cent, and 18.2 per cent, or 56 per cent of the total for the period. The Kern River field, which produced 16.4 per cent of the total production for the period 1859–1920, produced 7 per cent of the 1920 production.

The three groups of fields that have been producing longest are located in Southern California. The Ventura County and Newhall fields have been producing longer than any other group in the entire State. Notwithstanding the fact that these fields have been producing crude petroleum for more than 50 years, the production for the last year shown is larger than that for any previous year.

While the production of crude petroleum was first developed in Southern California, the largest production has been secured from the San Joaquin Valley Division, which includes the Midway, Coalinga, Kern River, Sunset, Lost Hills, Belridge, and McKittrick fields. As indicated above, the Midway, the Coalinga, and the Kern River fields, in this division, have been the three largest producers in the State, while during the same period the San Joaquin Valley Division produced over 71 per cent of such production.

The Midway field leads all others in the volume of its aggregate production and it has also had the largest production in a single year. As will be seen by comparison with Appendix Table 9, in the aggregate, the production of the Midway field alone surpasses that of several oil-producing States east of the Rocky Mountains. As already pointed out, the Sunset and Midway fields are frequently classed as one field. If their production were combined the aggregate production since their discovery would be greater than that for any of the oil-producing States except Oklahoma, Texas, Pennsylvania, and Ohio, and their present daily production would only be exceeded by that of the States of Kansas, Oklahoma, and Texas.

The Midway field was developed slowly, and during the first eight years its annual production was small. In 1910 there was a rapid increase in its production, the total for the year reaching 11,174,207 barrels, as compared with 2,234,455 barrels in 1909. The annual production increased rapidly until 1914, when the maximum of 37,479,228 barrels was produced. In 1915 there was a marked decrease in its production, which was attributed to litigation with the Federal Government, resulting from withdrawal orders, by which, late in 1912, about 67,800 acres were set aside as petroleum reserves for the exclusive use or benefit of the United States Navy. (See Chap. IV.) In 1920 this field produced 32,493,229 barrels, an increase of 6,000,000 barrels over the previous year. This was the largest production of any field in the State.

The aggregate production of the Coalinga field ranks next to that of the Midway field, and at the end of 1920 its total was 245,005,605 barrels. At the end of 1920 this field had been producing crude petroleum for 25 years. The maximum annual production of 19,546,000 barrels was produced in 1912. Three years later, in 1915, the annual production had declined 31 per cent, but during the following five years there was a gradual recovery until the production of 1920 showed a decrease of only 21 per cent, as compared with the maximum.

The aggregate production of the Kern River field ranks third among the oil fields of California. A total of 221,586,265 barrels had been produced by the end of 1920, at which time it had been producing crude petroleum for 21 years. The Kern River field was the first field in the entire State to develop a very large annual production. Its development was very rapid and its maximum annual production of 17,226,240 barrels was reached in 1904, only four years after the first annual production was recorded. During the 16 years following 1904 its production has declined 57 per cent.

The Whittier-Fullerton fields show the fourth largest aggregate production. These fields are located in the Southern California Division and in the year 1920 had a production second in size only to

that of the Midway field. These fields have been producing for 24 years and their 1920 production of 28,694,163 barrels was larger than that for any previous year. The Whittier-Fullerton fields comprise some of the most prolific pools in the State of California and the present daily average production per well in this field far surpasses that of any other field in the State. In December, 1919, with 887 wells in operation, the average daily production was 88 barrels per well, as compared with the next highest daily average of 44 barrels per well for the Santa Maria field.

From 1916 to 1920 the annual production of the Whittier-Fullerton fields almost doubled; this large increase was due to the development of the Montebello pool, which was discovered in 1917. The discovery well in the Montebello pool was brought in during March, 1917, and from that date to the close of 1919 this new pool had produced 19,823,534 barrels of crude petroleum. This volume of relatively high-grade crude was developed at a time of great need, and it was by far the most important factor in offsetting the decline in other fields and in increasing the production of the entire State from 1917 to 1920.

The aggregate production of each of the other fields is much smaller than for either the Midway, Coalinga, Kern River, or Whittier-Fullerton, yet their annual production forms an important contribution to the State's total. The Ventura County and Newhall fields, the Los Angeles and Salt Lake fields, and the Summerland field were in the order named the first fields developed in California, and prior to 1896 furnished the entire supply of California.

Excepting the sharp decline in production, resulting from curtailment of drilling operations, following the maximum production in 1914, which resulted from the flush production of the Midway and Sunset fields, the production of the California oil fields has maintained an almost constant increase for 30 years. This increase during the past 15 years has been due to the large annual production secured first from the Coalinga field, then from the Midway-Sunset, and since 1917 from the Whittier-Fullerton fields.

The column showing the percentage which each year's production is of the maximum production for each field, and for the State as a whole, shows that the California oil fields are long lived. As already stated, the Ventura County and Newhall group of fields have been producing for more than 50 years and the 1920 production was larger than for any previous year. The Whittier-Fullerton District did not reach its maximum production for 24 years, while the maximum production for the Coalinga field was reached in 17 years, the Sunset field in 15 years, the Midway, Los Angeles and Salt Lake fields in 15 years, and the McKittrick field in 12 years. The remaining fields were developed more rapidly. The Kern River field attained its maximum production in 5 years, the Summerland in 6 years, the Santa Maria in 7 years, and the Lost Hills and Belridge fields reached their maximum production in 8 years. None of the California fields has been abandoned, and most of them promise to be factors of importance for many years to come.

DAILY PRODUCTION PER WELL IN CALIFORNIA.—The statistics of the daily production of crude petroleum per well for the period 1903–1915 are given in Bulletin 73, published by the California State Mining Bureau (pp. 236–242). Since 1915 similar information is pre-

sented in the Standard Oil Bulletins, published by the Standard Oil Co. (California). The following table, compiled from the above-mentioned sources, gives the average number of wells operating annually, the average daily production per well, and the percentage which each year's average daily production is of the maximum daily production per well. The year of maximum daily production per well is indicated by 100.

TABLE 12.—*Average number of wells and average daily production of petroleum in California, 1903–1920.*

Year.	Average number of wells operated.	Daily average production per well.		Year.	Average number of wells operated.	Daily average production per well.	
		Barrels.	Percentage of maximum daily average production.			Barrels.	Percentage of maximum daily average production.
1903	2,494	26.7	55	1912	5,470	44.8	92
1904	2,763	29.2	60	1913	5,883	45.6	93
1905	2,397	39.2	80	1914	6,076	46.7	96
1906	2,381	37.6	77	1915	6,343	38.7	79
1907	2,633	41.7	85	1916	6,946	36.1	74
1908	3,136	42.1	86	1917	7,715	34.5	71
1909	3,699	43.1	88	1918	8,318	33.5	69
1910	4,353	48.9	100	1919	8,867	31.3	64
1911	4,992	46.0	94	1920	9,380	30.8	63

This table covers a period of 18 years, and during that time, except for the three-year period 1905–1907, there was a constant increase in the average number of wells operated annually. During the first eight years, with the single exception of 1906, there was a steady increase in the average daily production per well. The maximum average daily production was reached in 1910, and the five-year period beginning with 1910 includes the years of highest average daily production per well. This period was also one of great activity in drilling operations [8] and of rapidly increasing production in the Midway field. Beginning with 1915 the average daily production per well has declined steadily. This period of declining daily production per well coincides with declining production in the Coalinga, Midway, and Sunset fields. The 1920 average daily production of crude petroleum per well was 18.1 barrels per day less than that for 1910, which represents a decline of 37 per cent. During the same period the average number of wells operated annually increased from 4,353 to 9,380, representing an increase of more than 115 per cent.

DAILY PRODUCTION PER WELL IN VARIOUS STATES.—The average daily production per well in California is large as compared with that for most other oil-producing States. The daily average production per well based on the number of productive wells as of December 31, 1918, and the marketed production for that year, as reported by the United States Geological Survey, are shown in Table 13.

[8] See Appendix Table 5.

TABLE 13.—*Average daily production of petroleum per well by States, 1918.*

State.	Average daily production per well.	State.	Average daily production per well.
	Barrels.		*Barrels.*
Wyoming	37.07	Indiana	1.33
California	29.80	West Virginia	1.32
Louisiana	20.04	Ohio	.68
Texas	14.88	Pennsylvania and New York	.32
Kansas	14.34	Other States	3.92
Oklahoma	7.51		
Kentucky	3.30	United States	4.79
Illinois	2.29		

The information set forth in the foregoing table, together with a comparison of the number of producing wells and the marketed production, is shown in Appendix Table 10.

The production for each State includes the total quantity of crude petroleum marketed, as reported by the United States Geological Survey for the year 1918. On the other hand, the number of productive oil wells, as determined by the Geological Survey, includes the number of producing wells at the end of the previous year, to which is added the number of wells completed during the year, and from the total is deducted the number of wells abandoned during the year. It is obvious that all of the wells were not operated the entire year; furthermore, some wells were closed in at the end of the year. While it is impossible to obtain the exact average production per well, the averages shown for the different States are all determined on the same basis; hence the results can be accepted as indicative of the relative productive capacity of the wells in the different States in 1918.

There is a wide range in the daily average for the different States. In the pioneer fields of Pennsylvania and New York the daily production per well is very low, while in the Wyoming fields, which have been largely developed within the past few years, the average per well is comparatively high. Compared with Oklahoma, the average for Kansas appears high, but this was due to the initial production obtained from big wells drilled in the Butler County (Kans.) pool in 1917 and 1918. Many of these wells had a daily initial production ranging from 4,000 to 18,000 barrels. The comparatively high average in Texas and Louisiana was due to the large number of big wells brought in during 1918. In the Appalachian field, which comprises Tennessee, Kentucky, West Virginia, Pennsylvania, and New York, the daily average for Kentucky is much larger than for West Virginia or New York and Pennsylvania. This high average for Kentucky is due to the fact that the extensive development in this State is very recent, while New York and Pennsylvania have been developed for many years.

California had the second highest average production per day in 1918 and it far exceeded the average for any of the other large producing States except Wyoming. The average shown in the above table is not quite as high as is shown in Table 12. The difference is due to the fact that in the above table the number of wells comprise those productive at the end of the year, and the quantity is based

upon marketed production; while in the preceding table the number of wells was obtained by dividing the average number operated each month by 12 to get an annual average, and the actual production instead of marketed production was used. In this table in order to secure comparable averages the data were used on the same basis as for other States.

The most significant feature disclosed by the above table is the general low average production for the wells in the older fields east of the Mississippi River. In 1918 the fields west of the Mississippi River had 32 per cent of the producing wells and 88 per cent of the total marketed production, while the eastern fields with 68 per cent of the producing wells had only 12 per cent of the marketed production. The wells in the oil fields west of the Mississippi River show an average daily production per well of 13 barrels of crude petroleum, while those in the eastern section averaged less than 1 barrel per day.

The price of crude oil in the different fields has a big influence on the average daily production per well; for example, if the price for crude petroleum in the Appalachian field were no higher than that paid for the crude in the Mid-Continent field, a large number of wells which yield a very small production would be abandoned and consequently the daily average per well would be increased, while the total production would be decreased considerably.

Section 6. Production by companies.

SOURCES OF INFORMATION.—In order to secure accurate information covering the different phases of the production of crude petroleum in California, the Commission sent schedules to 412 different companies and individuals that were reported to be engaged in crude petroleum production. Replies were received from about 75 per cent of those to whom schedules were sent. Some of the reports received were from companies that had retired from the oil business, others were interested merely as royalty owners, and still others, having a production of from 1,000 to 75,000 barrels per year, could not furnish all of the information covered by the schedule. The number of companies furnishing information regarding production ranged from 125 in 1914 to 169 in 1918. Owing to the fact that some companies were unable to furnish a semiannual statement, there was a considerable decrease in the number reporting for the first six months in 1919. The reports which the Commission have been able to make use of include practically all the important oil-producing companies and a sufficient number of the intermediate and smaller ones to make the information representative for the crude petroleum producing industry of California.

The complete information secured by the schedules sent out by the Commission covers the period from January 1, 1914, to June 30, 1919. Certain information, such as prices, total production, stocks and foreign trade, have been secured to December 31, 1920, but information such as cost of production, production by individual producers, and other details pertaining to the business of individual companies have been secured only for the period January 1, 1914, to June 30, 1919.

PRODUCTION BY GROUPS.—The production of the companies reporting to the Commission has been tabulated in four groups, based on the

quantity produced by each company for each year. The first group includes all companies having a production of 1,000,000 barrels or more per year, group two includes those producing from 250,000 to 1,000,000 barrels, group three is made up of companies having a production of 50,000 to 250,000 barrels annually, and the fourth group embraces companies with a production of less than 50,000 barrels per year. The production of companies and individuals reporting to the Commission grouped, as explained above, is shown in Table 14, for the period 1914–June 30, 1919:

TABLE 14.—*Production of crude petroleum in California by groups of companies reporting, in barrels of 42 gallons, 1914–June 30, 1919.*

Year.	Group.	Range of production.	Number of companies.	Quantity.	Average per company.	Proportion by groups.	Proportion of State total.
				Barrels.	*Barrels.*	*Per ct.*	*Per ct.*
1914	1	Over 1,000,000	11	50,265,379	4,569,580	76.3	48.5
	2	250,000 to 1,000,000	18	9,207,863	511,548	14.0	8.9
	3	50,000 to 250,000	53	5,290,753	99,826	8.0	5.1
	4	Under 50,000	43	1,118,379	26,009	1.7	1.1
		Total	125	65,882,374	527,059	100.0	63.6
1915	1	Over 1,000,000	8	42,550,368	5,318,796	71.8	47.5
	2	250,000 to 1,000,000	20	10,572,668	528,633	17.9	11.8
	3	50,000 to 250,000	42	4,454,160	106,051	7.5	5.0
	4	Under 50,000	62	1,653,930	26,676	2.8	1.8
		Total	132	59,231,126	448,721	100.0	66.1
1916	1	Over 1,000,000	10	50,834,439	5,083,444	76.3	55.3
	2	250,000 to 1,000,000	19	8,879,891	467,363	13.3	9.7
	3	50,000 to 250,000	51	5,296,988	103,863	8.0	5.8
	4	Under 50,000	64	1,585,126	24,768	2.4	1.7
		Total	144	66,596,444	462,475	100.0	72.5
1917	1	Over 1,000,000	10	58,823,426	5,882,343	77.5	60.5
	2	250,000 to 1,000,000	19	9,255,178	487,115	12.2	9.5
	3	50,000 to 250,000	57	6,068,825	106,821	8.0	6.3
	4	Under 50,000	78	1,705,704	21,868	2.3	1.7
		Total	164	75,873,133	462,641	100.0	78.0
1918	1	Over 1,000,000	10	63,202,366	6,320,237	77.4	62.2
	2	250,000 to 1,000,000	22	10,541,776	479,172	12.9	10.4
	3	50,000 to 250,000	53	6,043,233	114,023	7.4	5.9
	4	Under 50,000	84	1,896,566	22,578	2.3	1.9
		Total	169	81,683,941	483,337	100.0	80.4
1919[1]	1	Over 1,000,000	12	33,968,353	2,830,696	80.4	67.1
	2	250,000 to 1,000,000	22	4,911,694	223,259	11.6	9.7
	3	50,000 to 250,000	45	2,556,486	56,811	6.0	5.1
	4	Under 50,000	72	825,211	11,461	2.0	1.6
		Total	151	42,261,744	279,879	100.0	83.5

[1] First 6 months.

In the above grouping there is a considerable shifting of individual companies. For example, two companies that produced over 1,000,000 barrels each in 1914, and were therefore placed in group 1, dropped to groups 2 and 4 the following year because the production of one company had fallen to less than 500,000 barrels and the other to less than 50,000 barrels.

The proportion of the total production of California, which is covered by reports to the Commission, increased steadily from 63.6 per cent in 1914 to 80.4 per cent in 1918, while the percentage for the first half of 1919 on an annual basis is 83.5 per cent.

Group 1, which includes companies producing 1,000,000 barrels and over each year, furnished the bulk of the production for each year. The proportion which this group produced of the total reported varied from 71.8 per cent in 1915 to 80.4 per cent for the first half of 1919, while this group contributed from 47.5 per cent in 1915 to 67.1 per cent for the first half of 1919 of the total for the State of California. The smallest quantity produced by this group for a full year was 42,550,368 barrels in 1915, and the largest 63,202,366 barrels in 1918. The average production per company increased from 4,569,580 barrels in 1914 to 6,320,237 barrels in 1918.

Group 2, which includes the production of companies having an annual production of from 250,000 to 1,000,000 barrels, shows its largest production for a full year of 10,572,668 barrels in 1915, and its smallest of 8,879,891 barrels in 1916. The largest proportion of the State's total produced by this group was 11.8 in 1915, and the smallest 8.9 in 1914. The average production per company for a complete year varied from 467,363 barrels in 1916 to 528,633 barrels in 1915.

In group 3, which includes companies producing from 50,000 to 250,000 barrels, the largest quantity of crude petroleum was produced in 1917 and the smallest for a full year in 1915. The proportion of the State's total production contributed by this group fluctuated from 5 per cent in 1915 to 6.3 per cent in 1917. The average production per company for a complete year varied from 99,826 barrels in 1914 to 114,023 barrels in 1918.

The production of group 4, which includes that for companies producing less than 50,000 barrels each year, increased from 1,118,379 barrels in 1914 to 1,896,566 barrels in 1918. In 1914 this group produced only 1.1 of the State's total, while in 1918 it was 1.9 per cent. The average production per company was lowest in 1917, when it was only 21,868 barrels. The highest average for a full year was 26,676 barrels in 1915.

The importance of companies producing 250,000 barrels or over is shown by combining groups 1 and 2. Throughout the period 1914–June 30, 1919, the production of these two groups varied from 89.6 to 92 per cent of the total reported to the Commission.. During the same period the first three groups, i. e., companies producing 50,000 or more barrels per year, produced from 97.2 to 98.3 per cent of the same total.

PRODUCTION BY LARGE INTERESTS.—The concentration of production is greater than indicated in the foregoing discussion, as several of the large crude petroleum producing companies control a number of allied and subsidiary companies. The total number of allied and subsidiary companies engaged in producing crude petroleum which were controlled by the principal producing companies in 1919 was as follows:

Controlling company	Number of allied and subsidiary companies.
Associated Oil Co.	10
Doheny Interests	7
Union Oil Co. of California	3
Santa Fe Railway Co.	2
Total	22

These 22 companies, together with the Associated Oil Co., the Union Oil Co., the Standard Oil Co. (California), General Petroleum Corporation, Shell Co. of California, and the Southern Pacific Co., include all but one of the more important crude petroleum producing interests in California. During the period covered the Southern Pacific Co. controlled the Associated Oil Co. through holdings of stock; hence, these two interests have been combined.[9] Reports were obtained from all of the above companies for the entire year 1919, so that information on their production covers the period 1914–1919. The production of the principal crude-petroleum producing companies and of their allied and subsidiary companies is shown in Appendix Table 11 for the period 1914–1919. The following table shows their production in 1914 and 1919:

TABLE 15.—*Production by seven large interests, in barrels of 42 gallons, 1914 and 1919.*

Interests.	1919		1914	
	Barrels.	*Per cent.*	*Barrels.*	*Per cent.*
Standard Oil Co. (California)	25,484,984	25.2	13,550,809	13.1
Southern Pacific-Associated Oil Co.	18,444,055	18.2	17,319,452	16.7
Union Oil Co. of California	8,705,447	8.6	6,329,978	6.1
Shell Co. of California	6,702,971	6.6	[1] 4,322,833	4.2
Doheny companies	5,836,799	5.8	4,980,659	4.8
Santa Fe Railway companies	3,754,299	3.7	3,170,517	3.0
General Petroleum Corporation	3,387,261	3.3	.....	.....
Total	72,315,816	71.4	49,674,248	47.9
Other companies reporting to Commission	[2] 6,987,712	6.9	16,208,127	15.7
Companies not reporting to Commission	21,918,256	21.7	37,741,320	36.4
Total production in California	101,221,784	100.0	103,623,695	100.0

[1] Production of Shell interests taken over by Shell Co. of California in 1915.
[2] First 6 months of 1919.

The production for the General Petroleum Corporation for 1916 includes only the last half of the year. Hence, the only accurate comparison that can be made for the group is for the period 1917–1919, during which time their production increased from 61,755,096 barrels to 72,315,816 barrels and their proportion of the total production of the State increased from 63.4 per cent in 1917 to almost 71.5 per cent. The combined production of the six interests shown for the entire period increased from 49,674,248 barrels in 1914 to 68,928,555 barrels in 1919; this represents an increase of almost 39 per cent; while the production of the State was 2.3 per cent lower in 1919 than in 1914. These six interests increased their proportion of the State's total from about 48 per cent to slightly more than 68 per cent.

Since 1918 the Standard Oil Co. (California) has been the largest single producer in the State of California. Its production increased from 13,550,809 barrels in 1914 to 25,484,984 barrels in 1919, an increase of over 88 per cent, while its proportion of the State's total production increased from about 13 per cent in 1914 to over 25 per cent in 1919. The large increase in its production beginning in 1917 was due to the company's discovery in March, 1917, of the Montebello pool, which has been an important factor in maintaining and increasing the production of the entire State, and which has yielded an increasing production in subsequent years.

[9] In December, 1920, the oil properties and oil interests of the Southern Pacific Co. were taken over by the Pacific Oil Co., which was organized for this purpose.

The Associated Oil Co.-Southern Pacific interests had the largest production from 1914 to 1917, while since that time these interests have ranked second. Their production fluctuated considerably from 1914 to 1919 and was slightly smaller in 1919 than in any of the preceding years, except 1914. In 1914 they produced about 16.7 per cent of the total for the State and in 1919 about 18.2 per cent of the total, while their maximum percentage was 21.6 per cent in 1916. In December, 1920, the producing interests of the Southern Pacific Co. and its control of the Associated Oil Co. was taken over by the Pacific Oil Co.

The production of the Union Oil Co. of California shows a steady increase from 1914 to 1919, except for the year 1915. In 1914 it produced 6,329,978 barrels and 1919, 8,705,447 barrels, an increase of over 37 per cent. In 1914 it produced slightly more than 6 per cent of the State total, while in 1919 its production equaled more than 8.5 per cent of that total.

As already stated, the Shell Co. of California was incorporated in 1915 and took over holdings owned by the same interests. The production shown for 1914 was produced by the California Oilfields (Ltd.), which was owned by the Dutch-Shell interests, which controlled the Shell Co. of California (Inc.), the predecessor of the Shell Co. of California. The production of its predecessor was 4,322,833 barrels in 1914, while that of the new company declined to 3,104,044 barrels in 1915. From 1915 to 1918 its production increased steadily, while the 1919 total was only slightly less than that for 1918. The 1919 total was almost 55 per cent greater than the production of the Shell interests for 1914, while its proportion of the total production of the State increased from about 4.2 per cent in 1914 to 6.6 per cent in 1919.

The seven Doheny companies produced 4,980,659 barrels of crude petroleum in 1914. From 1914 to 1917 their production decreased steadily to 3,312,497 barrels, after which time it began to increase until the 1919 total reached 5,836,799 barrels, a gain of over 17 per cent over 1914. The Doheny companies' proportion of the State total varied considerably during the period; in 1914 it was 4.8 per cent; by 1917 it had declined to 3.4, after which time there was a steady increase until in 1919 they produced 5.8 per cent of the total.

As already stated, the first production reported for the General Petroleum Corporation is for the last half of 1916. In 1917, the first full year, its production was 4,017,693 barrels. Since that time there has been a steady decline. The 1919 production shows a decrease of about 19 per cent as compared with 1917. The General Petroleum Corporation's proportion of the State's total production has declined from 4.1 per cent in 1917 to 3.3 per cent in 1919.

The production controlled by the Santa Fe Railway Co. decreased from 3,170,517 barrels in 1914 to 2,775,271 barrels in 1916, after which it increased steadily to 3,754,299 barrels in 1919. The gain in the six-year period was 18 per cent. Except in 1919 the Santa Fe's proportion of the State total was smaller than that of any other company in the State, and the change during the period has not been significant. In 1914 it produced 3 per cent of that total and in 1919 about 3.7 per cent.

The combined production of the seven interests shown for the entire period increased from about 48 per cent of the State's total production in 1914 to almost 71.4 per cent in 1919.

Section 7. Crude petroleum stocks.

MEANING OF STOCKS.—The relation between the supply of and the demand for crude petroleum is indicated by the quantity held in storage. When production increases more rapidly than consumption the quantity held in storage increases, and when consumption exceeds production the stocks of crude petroleum are depleted; hence the quantity held in storage is considered the barometer which shows the relations between crude petroleum supply and demand. Crude petroleum in storage in all of the oil fields of the country, except California, consists of refinable petroleum, while in California, on the other hand, much of the crude held in storage is ultimately sold for fuel-oil purposes without refining. The California stocks include crude petroleum and residuum in tanks in the field, in the pipe lines and pipe-line working tanks, and in storage tanks at the tank farms and refineries of the marketing companies, but they do not include stocks in the tanks of consumers of fuel oil nor the finished and semifinished products at the refinery. A relatively small quantity of tops, i. e., unfinished naphtha distillate, and the residuum obtained in distilling the tops, is also included in the stocks. Hence there is quite a difference in the character of crude petroleum stocks in California and for other sections of the country. Approximately 30 per cent of the crude production of California is the fuel grade—in former years it was almost 70 per cent—and that part of this grade remaining in the tanks of producers and marketers is included in all the available figures for stocks. The best statistics of stocks would be those showing the heavy and light fuel grades separately. The fact that the two grades of petroleum are not distinguishable in stocks renders the statement that prices decline as storage increases and advance as storage decreases, true only in a broad sense, so far as the prices of particular grades are concerned.

For a number of years past the Standard Oil Co. (California) and the Independent Oil Producers' Agency of Los Angeles have published monthly reports covering the important features of oil field operations. The statistics on drilling and production are quite similar, and therefore they are accepted for all general purposes, but for stocks of crude petroleum there has at times been a marked difference in their statistics.

In order to ascertain the method of securing this information the Standard Oil Co. (California) was asked to explain its statistics, and under date of March 24, 1920, the following information was furnished:

The crude oil statistics published in the Standard Oil Bulletin have been compiled by the company since 1900 as an index to the general relation of consumption to production. The figures are gathered in the field and are furnished by many oil operators and producers. When the company started its monthly publication, the Standard Oil Bulletin in 1913, it felt that the statistics belonged to the industry and they were, therefore, reproduced in the Bulletin for the first time in September, 1913.

Until the latter part of 1914 the figure "Crude oil stocks" represented solely crude oil stocks in the field, in transit between field points and refineries, and at terminals. This figure was an approximation, but as the figures of production and shipments from the field were fairly close, an observation of these figures over a period of several months, evidenced the relation between production and consumption. In 1915 and the early part of 1916, there was a great overproduction of refinable crude oil in the Midway Field. That part of the surplus which the company purchased was cared for by topping the oil at its Bakersfield Refinery in the Kern River fields, the tops approximating 30 per cent of the crude, going into steel tankage, and the residuum into

earthen reservoirs. This continued until about July, 1916, when the company had on hand approximately 7,000,000 barrels of residuum and 4,250,000 barrels of tops. These stocks for the purpose of the company's statistical report, were carried as crude oil stocks. At the end of 1919 all of the tops referred to had been exhausted and the residuum remaining in the company's field storage was 1,400,000 barrels.

Accumulations of residuum in the field as a consequence of topping crude oil are uncommon and often the identity of the residuum as such is completely lost through mixture with crude fuel oil.

After this country entered the war, the Federal Fuel Administrator on the Pacific coast complied his own statistics on production, consumption and stocks, and included in stocks all refinery stocks, taking into refinery stocks those tops above mentioned which the company had carried as part of crude oil stocks and apparently also carried as refinery stocks, a part of the residuum stock which the company had carried as crude oil stocks. The first statement of the Federal Fuel Administrator was published in May, 1918, and at that time the company discontinued the publication of its figures. The company, however, continued to compile its own statistics and at the end of the war when the figures of the Federal Fuel Administrator were discontinued with the statement of November, 1918, the company resumed the publication of its figures.

Crude oil stocks, as shown in the last published statement of the company, represent all crude oil stocks and residuum in fields, in transit, and at terminals, but do not include refinery stocks. The figures of crude oil stocks as of February 29 include an unknown quantity of residuum. On this date the company had approximately 1,000,000 barrels of residuum in field stocks, included in crude oil stocks. No effort is made to separately classify residuum for the reason that this product and crude fuel oil, representing about 40 per cent of the California production, are generally considered by the trade as the same product; that is, fuel oil.

The company states, however, in this connection, that it sells no crude for fuel, or any oil until it has passed through a refining process.

In this same connection, explaining the significance of a statement on crude petroleum stocks furnished to the Commission, the following explanation was made by the Independent Oil Producers' Agency:

This [statement] only shows stock conditions in respective oil fields, at tank farms, and along pipe-line systems, and does not include stocks at bay shore refineries, nor at terminals or other distributing points; hence, does not show the amount of residuum at refineries.

Subsequently, with reference to the quantity of refinery residuum included in its monthly statistics on crude petroleum stocks, information was obtained from the Independent Oil Producers' Agency that the residuum would run less than 1 per cent of its total stocks. On this basis the stocks reported by the agency as of December 31, 1919, would include about 278,000 barrels of refinery residuum. As stated above, the Standard Oil Co. (California) reported the quantity of crude petroleum held in storage for the same date included 1,400,000 barrels of residuum.

QUANTITY IN STORAGE.—The quantity of crude petroleum held in storage in California increased from 1910 to May, 1915 (see p. 230), and since that time there has been a gradual decrease until at the end of 1919 the quantity in storage was slightly less than that for December 31, 1910, while during 1920 there was a further reduction which almost sank to the January, 1910, total (see p. 230). The quantity held in storage at the end of each year from 1910 to 1920, as reported by the Standard Oil Co. (California), is given in the following table.

TABLE 16.—*Stocks of crude petroleum in California, in barrels of 42 gallons, as reported by the Standard Oil Co. (California), Dec. 31, 1909–1920.*

Year.	Barrels.	Year.	Barrels.
1909	19,698,761	1915	57,147,051
1910	30,852,863	1916	44,036,190
1911	41,663,114	1917	32,450,465
1912	45,661,666	1918	32,042,923
1913	47,870,177	1919	30,490,323
1914	58,526,274	1920	22,240,271

The period ending with May, 1915, was one of overproduction of crude petroleum and of accumulating stocks, while since that time the current production has been less than current consumption and the quantity held in storage has decreased. The large war demand for fuel oil and other petroleum products which began in 1916, accompanied by a small increase in production, resulted in heavy withdrawals from storage in 1916 and 1917; during 1918 there was little change, while in 1919 and 1920 demand was so great that notwithstanding large production, which was larger in 1920 than in any previous year, there was a large reduction in the quantity held in storage. The monthly stocks of crude petroleum in California as reported by the Standard Oil Co. (California) and the Independent Oil Producers' Agency, 1914–1920, are shown in Appendix Table 12.

Section 8. Comparison of consumption and production.

The consumption of crude petroleum in California has been greater than the annual production each year since 1915. The annual deficit has been supplied by withdrawals from stocks and particularly in 1919 and 1920 by shipments of gasoline into the Pacific coast territory from the Wyoming and Mid-Continent oil fields.

An adequate supply of crude petroleum is more vital to the Pacific coast than to any other section of the United States, because it furnishes the fuel supply for practically all of the manufacturing industries, the transportation facilities, the mining enterprises, and for the public utilities of the entire Pacific coast territory. The relation between the annual consumption and production of crude petroleum for the Pacific coast territory, as shown by variations in the quantities in storage, is presented in Table 17.

TABLE 17.—*Quantity of crude petroleum produced and consumed in California, in barrels of 42 gallons, 1910–1920.*

Year.	Consumption.		Production.	
	Total.	Excess.	Total.	Excess.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*
1910	66,543,466	.....	77,697,568	11,154,102
1911	72,933,793	.....	83,744,044	10,810,251
1912	86,075,887	.....	90,074,439	3,998,552
1913	95,658,673	.....	97,867,184	2,208,511
1914	92,967,598	.....	103,623,695	10,656,097
1915	90,946,002	1,379,223	89,566,779	.....
1916	104,933,223	13,110,861	91,822,362	.....
1917	108,853,557	11,585,725	97,267,832	.....
1918	102,045,412	407,542	101,637,870	.....
1919	102,784,384	1,562,600	101,221,784	.....
1920	113,961,238	8,240,052	105,721,186	.....

The annual totals for consumption shown above were computed by deducting from the sum of the stocks at the beginning of the year plus the year's production the quantity in storage at the end of the year.

From 1910 to 1914, inclusive, production exceeded consumption and during these five years 38,827,513 barrels were placed in storage. Beginning in 1915 and continuing through 1920 consumption exceeded production, the excess for the six years being 36,286,003 barrels. During the eleven years from 1910 to 1920 production and consumption were almost equal, the excess of production being only 2,541,510 barrels. The largest excess of production occurred in 1910, while 1911 and 1914 also show an excess of approximately 11,000,000 barrels each year, while in the latter year consumption had increased 40 per cent over 1910. The largest excess of current consumption over current production occurred in 1916 and 1917, when it was 13,111,000 and 11,586,000 barrels, respectively. The very large consumption in these years was the result of the heavy war demand. The year 1920 shows an excess of 8,240,000 barrels over the highest annual production ever recorded for California. The Wyoming and Mid-Continent oil fields were also drawn upon for very large supplies of gasoline. At the end of 1920 consumption was 47,417,772 barrels, or 71 per cent greater than in 1910, while the production had increased 28,023,618 barrels, or 36 per cent.

At the beginning of 1910 the surplus crude petroleum held in storage was 19,698,761 barrels, while on December 31, 1920, it was 22,240,271 barrels, or only 2,541,510 barrels greater than at the beginning of 1910. While the actual quantity held in storage was slightly larger at the end of 1920 than it had been 11 years earlier, the quantity held in storage was relatively smaller when the large increase of 71 per cent in the annual consumption is taken into consideration. In 1910 the quantity in storage was sufficient to supply the demand for 106.5 days, while the quantity in storage at the end of 1920 was only sufficient for 70.3 days.

Section 9. Importance of an adequate supply.

An adequate supply of crude petroleum is more important for the Pacific coast than for any other section of the country, as it constitutes the main or only source of fuel for heating purposes, marine, and river navigation, public utilities, railways, and for the mining and manufacturing industries. Even the dependence upon gasoline and other motor fuels is greater in California than in any other section of the country for use by the agricultural and horticultural industries. The California oil fields are drawn upon to supply most of the industries of Arizona, California, Nevada, Oregon, and Washington with fuel oil and refined products. The absence of an adequate supply of coal and its relatively high price make fuel oil a very important factor in the entire Pacific coast region.

During the 11-year period 1910–1920 consumption and production have been about equal, 1,037,703,233 barrels having been consumed, while the 11-year production has been 1,040,244,743 barrels. Consumption has shown quite a steady increase from 66,543,000 barrels in 1910 to 113,961,000 barrels in 1920, which represents an increase of 71 per cent. During the same period production has fluctuated considerably, from 1910 to June, 1915, it exceeded consumption, while since that time consumption has been

greater and the California industry has drawn upon stocks until at the end of 1920 the quantity held in storage was only about 2,542,000 greater than on January 1, 1910. The largest annual production was recorded in 1920, when 105,721,000 barrels were produced, or about 8,240,000 less than the same year's consumption. The consumption will probably continue to increase. This condition has caused anxiety regarding the ability of the California industry to produce sufficient crude petroleum to meet the growing demand. During the latter part of 1919 and in the first half of 1920 there was a shortage of gasoline and a threatened shortage of fuel oil. In order to relieve this shortage about 20,000,000 gallons of gasoline in 1919 and approximately 84,000,000 gallons in 1920 were secured by the Standard Oil Co. alone from the Wyoming, the Mid-Continent, and Mexican oil fields.

There has been a marked increase in the production of crude petroleum during the latter part of 1920 and in the early months of 1921, and the situation on the Pacific coast is not as unfavorable as it appeared in the early part of 1920. At the close of 1920 the Pacific coast petroleum industry was in a better position to take care of current demands than it had been for many months previous. In June, 1921, the average daily production of crude petroleum in California was 337,000 barrels as compared with 273,000 barrels in 1920. This was an increase of 64,000 barrels per day, or 23 per cent over the same month of 1920. The production for the first half of 1921 established a new record for the California oil fields, and should the same average be maintained during the remainder of the year the total production for 1921 would exceed 120,000,000 barrels. Another significant fact in this connection is that for the first time in eighteen months the quantity of crude petroleum held in storage beginning with January, 1921, showed an increase; in other words, while consumption increased it was exceeded by production.

In addition to the present increased production in California, indications are that substantial relief may be expected from the Mexican oil fields. Announcement has recently been made that two of the largest oil companies in California—the Standard Oil Co. (California) and the Union Oil Co. of California—have already taken steps to relieve the shortage by importing large quantities of Mexican fuel oil and "tops," i. e., unfinished naphtha distillate. The tops are to be refined into gasoline, thus furnishing an entirely new supply of this product. In addition to this action by the oil companies themselves, private companies are building a fleet of tank steamers which will operate between California and Mexican ports.[10]

The question of an adequate supply of petroleum products for the Pacific coast depends largely upon the ability of the California industry through more extensive exploration and drilling to increase the present production of the California oil fields; to increase efficiency of refinery operations so as to recover a larger proportion of gasoline from the crude petroleum to refine the greatest possible quantity of all grades of crude petroleum, leaving only the residuum to be utilized with strictly nonrefinable crude for fuel purposes, and to supplement the domestic supply by imports to meet whatever shortage may result through the failure of the California fields to keep up with current demands.

[10] Oil, Paint, and Drug Reporter, Jan. 17, 1921, p. 9.

CHAPTER IV.

WITHDRAWALS OF OIL LANDS.

Section 1. Reasons for withdrawals.

In 1909 large areas of oil lands in California and other States were temporarily withdrawn from disposition under the public land mineral laws. The main reasons for the withdrawal of these lands were: To prevent overproduction and the consequent waste of crude petroleum; to reserve a supply for the Navy; and to preserve the oil lands from disposition under the placer mining law, pending the enactment of legislation by Congress providing for a more satisfactory method of mineral land administration. Much of the land included in the areas withdrawn was patented land and a large part of the remainder was claimed under the placer mining law by various companies and individuals. This led to a great deal of litigation, much of which was still pending in February, 1920, when the mineral land leasing law was enacted, which radically altered the method of administering the public domain underlaid by nonmetallic minerals, including petroleum, by providing for the leasing of such lands instead of disposing of all title to them by patent, as the law stood prior to the enactment of this mineral leasing law.

Section 2. Petroleum public land laws.

A proper understanding of the effect of the withdrawals of the oil land can be secured only after some consideration of the petroleum land laws, under which a large part of the lands withdrawn were claimed by various interests.

The first general mining law of the United States covering the public domain was the "lode" law, enacted in 1866, which provided that mining claims "upon veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper, or other valuable deposit * * * may be located."[1] In 1870 the placer law covering minerals not in veins or lodes was enacted providing for the location of placer claims "under like circumstances and conditions and upon similar proceedings to those for lode claims."[2] These mining laws were amended in certain particulars in 1872, but there was no further change in them for 25 years. The petroleum placer law approved February 11, 1897, provided that lands chiefly valuable for petroleum might be located "under the provisions of the laws relating to placer mining."[3] It appears that public petroleum lands had been taken up under the placer law for a number of years before the passage of this act, but in August, 1896, the Secretary of the Interior, in the Union Oil case, decided that petroleum lands could not be located and patented under the placer law.[4] The act of February 11, 1897, was the result of this decision.

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[1] Revised Statutes, sec. 2320, and 14 Stat., 251.
[2] Revised Statutes, sec. 2329, and 16 Stat., 217.
[3] Revised Statutes, sec. 2331, and 29 Stat., 526.
[4] 23 Land Decisions, 222.

The more important provisions of the placer law as applied to petroleum claims at the time of the withdrawals in 1909 were: That no locations could be made without a prior discovery of valuable oil deposits in place on the claim; that no claim for an individual should exceed 20 acres, or for an association of eight persons, 160 acres; and that discovery must be made on each claim. There was no limit, however, to the number of claims which might be located by a single individual or association.

The placer mining laws of the United States were enacted long prior to the discovery of crude petroleum or gas on the public domain. Unlike lode or placer deposits of gold or other minerals found on or near the surface, petroleum is ordinarily not found until after expensive drilling, in some cases to depths of 4,000 feet or more. However, the location of a mineral claim was not a valid claim as against second parties until mineral had been discovered, and could be held prior to discovery only by diligent prosecution of work leading to discovery. It could not be held as against the Government until discovery had actually been made.

The provision of the placer law that an association of eight persons could perfect title to 160 acres under one discovery, while an individual or corporation could perfect title to only 20 acres under one discovery led to extensive fraud through the use of dummy locators by individuals and corporations that desired to secure title to the same acreage by one discovery under an association claim as would require eight discoveries under individual claims. A dummy locator may be defined as a person who locates or whose name is used to locate mining claims on public land when he himself has no interest in the claim.

Section 3. Withdrawals of oil lands.

EARLY WITHDRAWALS.—The first withdrawal of public lands due to the presence of petroleum deposits was on March 17, 1865, when the Commissioner of the General Land Office requested the register and receiver at Humboldt, Calif., to withhold certain land reported to contain petroleum deposits "from disposal by the Government, unless otherwise specially instructed." [5] There is no further record of oil land withdrawals until 1900, when certain lands in California and Wyoming were withdrawn from agricultural entry on representations made by citizens of those States that the lands contained valuable deposits of crude petroleum.

The more recent withdrawals of oil lands in California are comprised under two periods: (1) The period of withdrawal from agricultural entry, 1900–1909; and (2) the period of withdrawal from mineral entry, September 27, 1909, to February 25, 1920.

WITHDRAWALS FROM AGRICULTURAL ENTRY.—As already stated, certain lands were withdrawn from agricultural entry in California and Wyoming in 1900. These withdrawals protected the oil operators from agricultural entrymen pending the determination of oil-bearing character of the lands. From 1900 to 1909 large areas of land were withdrawn from agricultural entry, a large part of which was restored from time to time as evidence of its nonoil-bearing

[5] U. S. Geological Survey Bulletin 623, p. 60.

character appeared, but in some cases the restored land was later again withdrawn.

The reason for practically all of the oil land withdrawals made prior to 1909 was to protect legitimate oil operators who were trying to secure title to the land by making a discovery of crude petroleum from fake homestead entrymen, who were attempting to secure title to valuable oil lands under the homestead law. The lands were not withdrawn from mineral entry prior to September 27, 1909.

WITHDRAWALS FROM MINERAL ENTRY.—While a number of withdrawals from agricultural entry were made prior to September 27, 1909, the first withdrawal of petroleum lands from mineral entry in California was made under temporary petroleum withdrawal No. 5, dated September 27, 1909, and covered 2,871,000 acres of land in California and 170,000 acres in Wyoming. This order, which was signed by A. C. Rizer, Acting Director of the United States Geological Survey, and approved by Frank Pierce, Acting Secretary of the Interior, was as follows: [6]

> In aid of proposed legislation affecting the use and disposition of the petroleum deposits on the public domain, all public lands in the accompanying lists are hereby temporarily withdrawn from all forms of location, settlement, selection, filing, entry, or disposal under the mineral or nonmineral public land laws. All locations or claims existing and valid on this date may proceed to entry in the usual manner after field investigations and examination.

The acreage withdrawn included large tracts of land that had already been patented, which, of course, were not affected by the withdrawal order. Although this withdrawal order was dated September 27, it apparently did not come to the general knowledge of the oil men in California until some time in November.

As stated in the withdrawal order, the land was withdrawn in aid of proposed legislation, but there were also other reasons for the withdrawal. One of these was the importance of reserving a sufficient acreage of oil lands to afford a supply of fuel oil for the United States Navy in future years. Another was to prevent any increase of the overproduction of crude petroleum in California and the consequent waste of its more valuable constituents, which takes place while in storage. It was also feared that under the inadequate placer law the oil supply of the future would fall into the hands of monopolistic interests. These reasons were in a way but different forms of the idea of conservation of the natural resources of the Nation, that was at that time becoming general throughout the country.

PICKETT RELIEF ACT.—The withdrawal order of September 27, 1909, was understood as cutting off all but valid legal claims based upon the actual discovery of crude petroleum and held in compliance with the placer-mining law. At this period there was great activity in certain parts of the withdrawn lands in California, in the development and exploitation of new fields. Naturally, the withdrawal order caught the operators in every conceivable stage of development from those who had made only "paper" locations to those who had almost drilled to the petroleum deposits.

In order to protect claimants under the placer law, who had spent large sums of money in drilling for crude petroleum, or in preparing to drill, Congress passed the Pickett Act, which was approved by the President on June 25, 1910. This act, after expressly authorizing

[6] U. S. Geological Survey Bulletin 623, p. 135.

the President to make temporary withdrawals of public lands, provided:[7]

> That the rights of any person who, at the date of any order of withdrawal heretofore or hereafter made, is a bona fide occupant or claimant of oil or gas-bearing lands and who, at such date, is in diligent prosecution of work leading to the discovery of oil or gas, shall not be affected or impaired by such order so long as such occupant or claimant shall continue in diligent prosecution of said work.

The above proviso was inserted at the request of a delegation of California oil operators who appeared before the public lands committees of both Houses of Congress in May, 1910, and urged that the withdrawal order, if valid, would cut off the rights of every prospector who had not made a discovery, although he was in actual bona fide possession of the land and engaged in diligent prosecution of work leading to discovery at the date of the order. The leading decision of the California Supreme Court recognizing the rights of one in diligent prosecution of such work as against adverse claimants was cited to the committees,[8] and the relief asked for and granted was that the claimant be given the same rights against the Government that he already had against adverse claimants.

WITHDRAWAL OF JULY 2, 1910.—Under the provisions of the Pickett Act the President confirmed the prior withdrawals of oil lands by the following order made on July 2, 1910:[9]

> It is hereby ordered that those certain orders of withdrawal made heretofore * * * in so far as the same include any of the lands hereinafter described, be, and the same are hereby ratified, confirmed, and continued in full force and effect; and subject to all the provisions, limitations, exceptions, and conditions contained in the act of Congress entitled "An act to authorize the President of the United States to make withdrawals of public lands in certain cases," approved June 25, 1910, there is hereby withdrawn from settlement, location, sale, or entry, and reserved for classification and in aid of legislation affecting the use and disposal of petroleum lands belonging to the United States, all of those certain lands of the United States, set forth and particularly described as follows, to wit: * * *

The withdrawal order of July 2, 1910, was the first order actually approved by President Taft, the preceding orders having been finally approved by the Secretary or the Assistant Secretary of the Interior.

ASSIGNMENT RELIEF ACT.—After the passage of the Pickett Act further relief of another character was asked by the oil operators as the result of a decision made in January, 1911, by the Secretary of the Interior in the Bakersfield Fuel and Oil case. It was held in this case "that a placer location of 160 acres, made by eight persons and subsequently transferred to a single individual before discovery, can not be perfected by the transferee upon a subsequent discovery to over 20 acres."[10]

Relief from this ruling was asked by a committee of California oil producers, as practically all the oil claims that had been made by associations of eight persons in California had been transferred to a single person or companies prior to discovery. The relief desired was granted in an act approved March 2, 1911, which provided that patent should not be denied because of the assignment or transfer of an association claim to one person or corporation before discovery "if such claim is in all other respects valid and regular."[11]

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[7] 36 Stat., 847.
[8] Miller v. Christman, 140 Calif., 440, and 197 U. S., 313.
[9] U. S. Geological Survey, Bulletin 623, p. 183.
[10] 39 Land Decisions, 461, and 38 Land Decisions, 59.
[11] 36 Stat., 1015.

NAVAL PETROLEUM RESERVES.—Although the future needs of the United States Navy for fuel oil was one of the reasons for the withdrawals of public oil lands, such fact was not stated in any of the withdrawal orders prior to 1912, nor was any portion of the lands withdrawn definitely assigned to the Navy at the time of the withdrawal. In 1912, however, two naval petroleum reserves were set aside from the withdrawn lands. The area comprised in these two reserves was included within the limits of the land withdrawn on September 27, 1909, so that the naval reserves were not new withdrawals, but only the setting aside of certain withdrawn areas for a definite purpose.

Naval reserve No. 1 was set up on September 2, 1912, and includes 37,720 acres in the Elk Hills and Midway fields, located in Kern County, Calif. Naval reserve No. 2 was set up on December 13, 1912. It is located south of and contiguous to Naval reserve No. 1, and includes 30,080 acres. Much of the land in both naval reserves in California was patented land.

OPERATING AGREEMENT ACT.—Suits brought by the United States Government in 1913 against claimants on the withdrawn lands in California also included the marketing companies purchasing crude petroleum from these lands. The marketing companies thereupon, in the fall of 1913, refused to continue purchasing the crude petroleum unless they were protected from loss by bond or otherwise. In the spring and summer of 1914, therefore, representatives of the California oil operators appeared before the public lands committees of both houses of Congress, urging relief from this condition, as many of them could not give further bond and would be forced to close down, to the permanent injury of the property. In response to this appeal Congress passed the operating agreement act, which was approved August 25, 1914. This act gave the Secretary of the Interior authority to enter into agreements with producers on withdrawn lands "relative to the disposition of the oil or gas produced therefrom, or the proceeds thereof, pending final determination of title thereto by the Secretary of the Interior."[12]

The Secretary of the Interior entered into over 40 such contracts, but none of them in the naval reserves, because by agreement between the Secretary of the Navy, the Secretary of the Interior, and the Attorney General suits were brought against claimants in the naval reserves. Under practically all of the agreements made by the Secretary of the Interior with California producers one-eighth of the proceeds from the crude petroleum produced was put in escrow to await decision as to the ownership of the land. Where there were adverse claimants, however, which was especially the case in Wyoming, the entire proceeds, less operating expenses, were impounded.

Section 4. Litigation involving withdrawn lands.

NATURE OF THE LITIGATION.—This litigation consisted of three classes which were: (1) Suits to enforce the provisions of the withdrawal orders and to protect the property against trespassers; (2) suits against the Southern Pacific Co. to cancel patents, which it was alleged had been obtained by fraud; and (3) adverse proceedings in

[12] 38 Stat., 708.

the General Land Office against the granting of patents. The second class of suits, those against the Southern Pacific Co., did not involve the withdrawal orders, and could have been prosecuted even if no withdrawals had ever been made. They are discussed here, however, as they affected land in the withdrawn areas, and because they would probably never have been brought had the withdrawals not been made. Many of the so-called withdrawal suits also did not actually involve the withdrawal orders, as they were based upon fraudulent locations, and could also have been prosecuted if the lands had not been withdrawn. But all suits involving withdrawn lands in California are discussed here, as they all resulted from investigations brought about by resistance to the withdrawal orders.

The withdrawal of September 27, 1909, was quite generally disregarded in both California and Wyoming. It was regarded by many claimants as clearly invalid, as being beyond the President's authority, the Constitution having placed the disposition of the public lands in Congress, and Congress had enacted the placer mining laws, which covered the only method of disposition of petroleum public lands, and had not at any time prior to June 25, 1910, authorized the President to withdraw such lands from disposal. Suits were brought by the Government in the United States district courts, both in California and Wyoming, to enforce compliance with the withdrawal order of September 27, 1909. In the California suits there were also allegations of fraud in the use of dummy locators.

MIDWEST OIL CO. CASE.—The case against the Midwest Oil Co., in Wyoming, being free from disputes of fact and the other complications of the California suits, was selected by the Attorney General for the purpose of securing a speedy determination of the President's authority to make the withdrawal. The bill in the Wyoming case against the Midwest Oil Co. was filed in February, 1913, and on June 14, 1913, Judge Riner, of the United States district court in Wyoming, rendered a decision dismissing the bill upon the ground that the order of the President was ineffective to prevent a lawful location of the land in controversy under the mining laws.[13] The Attorney General appealed the case to the circuit court of appeals for the eighth circuit, which certified the main questions to the United States Supreme Court for answer.[14] The Supreme Court in its decision on February 23, 1915, in the United States *v.* Midwest Oil Co.[15] reversed the district court and upheld the power of the President, even in the absence of specific authority from Congress, to withdraw public lands and reserve them for public purposes.

After the validity of the withdrawal orders issued prior to July 2, 1910, had been thus established a large number of other suits were brought, especially in California, to have receivers appointed and to protect the property during the pendency of proceedings in the Interior Department to determine ownership of the lands as between the claimants and the Government. Only five suits had been brought prior to February 23, 1915, when the Midwest decision was rendered. During the spring and summer of 1915, 25 such suits were filed. Up to February 28, 1918, there had been in-

[13] 206 Fed., 141.
[14] Report U. S. Attorney General, 1913, pp. 40–41, and 1914, p. 37.
[15] 236 U. S., 459.

stituted 55 suits in California, and on June 30, 1920, there were 40 California cases still pending in the district court and 2 in the higher Federal courts.

SUITS TO PROTECT WITHDRAWN LANDS FROM TRESPASSES.—There were three classes of charges in the withdrawal suits: (1) That the claimants were not engaged in the diligent prosecution of work leading to discovery at the date of withdrawal; (2) that there were "dummy" locators involved; (3) that there was subterfuge, that is, the claims were based on the discovery of gypsum or fuller's earth, but the land was really desired because of the value of its petroleum deposits.

The first class, where there was no diligent prosecution of work leading to discovery, was the only one which, strictly speaking, involved the withdrawal orders. The other two classes—dummy locators and subterfuge discoveries—had no connection with the withdrawal policy. Dummy locations were contrary to the provisions of the placer mining law, which required a bona fide association of eight persons to locate a claim of 160 acres under one discovery. The fraud in the use of dummies consisted of one individual or corporation seeking by this device to acquire a larger area of public lands with one discovery than the law allowed.

A prominent California oil operator, Thomas A. O'Donnell, stated before a committee of Congress in 1914 that over 90 per cent of all locators in California were dummies. Mr. O'Donnell said:[16]

> It is my judgment, gentlemen, that 90 per cent of all locators in California on these lands were dummy locators; in fact * * * I would like to go further now and say that 90 per cent of all locations that were ever made out there, including patented lands where patents have been issued heretofore, were the same kind of locations. It was the custom of my lifetime.

The result of these suits was the granting of relief to the Government in a large number of cases, either by injunction or the appointment of a receiver, who was empowered to protect the property and impound the proceeds until the title to the land was settled. As to determining the title to the lands in dispute the courts were powerless, this being the function of the General Land Office and the Secretary of the Interior. Adverse proceedings were therefore instituted in the General Land Office against applications for patents, so as to determine the title to the land, but most of these contests were still undecided when the mineral leasing law was passed in February, 1920.

SOUTHERN PACIFIC CASES.—The first suit against the Southern Pacific Co. was brought in December, 1910, by Attorney General Wickersham, and involved about 6,000 acres of land in Naval reserve No. 1, in the San Joaquin Valley in California, which had been patented to the Southern Pacific in 1904. It was known as the Elk Hills suit. Six other suits were later filed, involving about 160,000 acres of land in the San Joaquin Valley, which had been patented to the Southern Pacific in the early nineties. The latter six suits were afterwards consolidated and heard as one case. As already stated, the Southern Pacific suits were quite dissimilar to the withdrawal suits, the facts, principles, and issues all being entirely different. The fraud alleged in the Southern Pacific suits was that the Southern

[16] Hearings on Exploration for and Disposition of Oil, Gas, etc., House Committee on Public Lands, 63d Cong., 2d sess., pp. 91, 328.

Pacific officers and agents knew that the lands were mineral lands at the time the company filed its selected list for agricultural lands and received patent. The act of July 27, 1866, under which the Southern Pacific Co. received patents for the land, expressly excepted and reserved mineral lands, except those containing coal and iron, from the operation of the grant. The seven Southern Pacific suits mentioned above involved all the oil lands owned by the Southern Pacific Co. in California except two small parcels of a few hundred acres.

The Elk Hills case, involving about 6,000 acres of land, valued at $18,000,000, was submitted to the district court in January, 1915, and in June, 1915, a decision was handed down favorable to the Government, holding the lands involved to be mineral in character, and that the patent therefor had been procured through fraud,[17] that is, that the railroad officials knew these lands to be oil lands when the patents were applied for in 1904. The company appealed to the circuit court of appeals on February 1, 1916, and on May 6, 1918, this court reversed the decision of the district court.[18] On August 3, 1918, Attorney General Gregory docketed an appeal to the Supreme Court of the United States. The decision of the Supreme Court rendered November 17, 1919, reversed the circuit court of appeals and confirmed the decision of the district court in favor of the Government.[19]

The consolidated suit, involving about 160,000 acres, valued at over $500,000,000, was submitted to the district court in April, 1918, and on August 28, 1919, a decision was handed down by the district judge adverse to the United States.[20] The deciding feature of the consolidated case seems to have been that the railway company offered to sell and did sell some of the lands at a few dollars per acre, thus showing conclusively, as interpreted by the district judge, that the railroad officials did not know that the lands were oil lands when they applied for and received the patents for them. In December, 1919, Attorney General Palmer announced that there would be no appeal by the Government from the adverse decision of the district court [21] in the consolidated case.

Section 5. Effects of withdrawals on production.

GENERAL EFFECT OF WITHDRAWALS.—A large area of oil lands in California was withdrawn from location in 1909, under the mineral laws, after there had been extensive drilling for a number of years on these lands. However, there was little interference with the continued development of these withdrawn lands until after the decision of the Supreme Court in the Midwest case in February, 1915. After this date the lands remained practically withdrawn from development until after the enactment of the mineral land leasing law in February, 1920. When the mineral land leasing law is in full operation the development of these lands, which have been arrested for so many years, can be continued. It must be understood, of course, that the oil lands withdrawn were only a small part of the total area of such

[17] 225 Fed., 197.
[18] 249 Fed., 785.
[19] 251 U. S., 1. See also Report U. S. Attorney General, 1912, p. 40; 1915, p. 37; 1916, p. 46; 1918, p. 92; and 1919, p. 93.
[20] 260 Fed., 511.
[21] For the Attorney General's explanation of his reasons for not appealing this case, see the extract from the annual report of the Attorney General for 1920, quoted in the Exhibit, page 221.

lands in California, as much of the oil territory of the State is on privately owned lands.

ACREAGE WITHDRAWN.—In California the withdrawal order of September 27, 1909, covered 2,267,000 acres, which included a large acreage of patented land. Further withdrawals were made in 1909 and 1910, which in spite of the restoration of 378,456 acres as nonoil-bearing land, increased the acreage withdrawn to 2,482,750 on May 15, 1910. The greater part of this acreage was patented land. By June 30, 1912, restorations of nonoil-bearing lands had reduced the outstanding withdrawals to something over 1,500,000 acres. In April. 1914, outstanding withdrawals covered 1,392,738 acres, of which 969,458 acres were patented, 105,306 acres were covered by pending applications for patent, and 317,974 acres had no claim filed against them, although mostly covered by unfiled claims. The acreage remaining withdrawn on April, 1915, June 30, 1916, and June 30, 1917, is shown in the following table:

TABLE 18.—*Acreage of patented and unpatented lands withdrawn, 1915-16.*

Status.	April, 1915.[1]	June 30, 1916.[2]	June 30, 1917.[3]
	Acres.	*Acres.*	*Acres.*
Patented land	1,055,184	899,104	861,580
Unpatented land:			
Mineral entries	40,790	35,540	34,206
Agricultural entries	60,911	84,862	8,400
Railroad selections	160	.....	.....
Vacant or covered by mineral location	350,833	.....	.....
Vacant or covered by agricultural entry	.....	341,609	348,000
Total unpatented	452,694	462,011	390,606
Total withdrawn	1,507,878	1,361,115	1,252,166

[1] Report Committee on Petroleum, California Council of Defense, p. 43.
[2] Hearings oil leasing bill, Joint Conference, 64th Cong., 2d sess., p. 63.
[3] Report Commissioner General Land Office, 1917, p. 8.

On June 30, 1920, there were outstanding withdrawals of 1,257,229 acres with very little change in the status as compared with that of three years before, except for the transfer of about 6,000 acres from the patented lands to the vacant lands, through the winning of the Elk Hills suit against the Southern Pacific Co. in November, 1919.

STATUS OF LAND IN NAVAL RESERVES.—The most productive oil land in the withdrawn areas in California is in the naval reserves. The status of the land in these reserves did not change much prior to the winning of the 6,000-acre suit against the Southern Pacific Co. by the Government in 1919. The status in 1918 and 1920 is shown by the following table:

TABLE 19.—*Status of withdrawn oil lands in the naval reserves, 1918 and 1920.*

Naval reserve.	1918	1920
No. 1:		
Patented—	*Acres.*	*Acres.*
Southern Pacific Co	10,720	4,640
Others	1,280	1,280
Not patented—		
In litigation	320	320
Not in litigation	25,400	31,480
Total	37,720	37,720

TABLE 19.—*Status of withdrawn oil lands in the naval reserves, 1918 and 1920*—Con.

Naval reserve.	1918	1920
No. 2:		
Patented—	*Acres.*	*Acres.*
Southern Pacific Co.	15,360	15,360
Others	3,680	3,520
Not patented—		
In litigation	8,160	8,160
Not in litigation	2,880	3,040
Total	30,080	30,080

In reserve No. 2 about 15,000 acres is proven oil land, of which about 9,000 acres are patented and about 6,000 acres unpatented.

The land "in litigation" refers to lands in suits under the withdrawal orders. The Southern Pacific patented land in both reserves was also in litigation in 1918, but under the law granting the lands, and not under the withdrawal orders. The principal interests in the 8,160 acres in litigation in naval reserve No. 2 in 1918 were the following:

	Acres claimed.
Honolulu Consolidated Oil Co.	2,720
Standard Oil Co.	1,620
Associated Oil Co.	880
North American Oil Co.	640
Midland Oil Fields Co.	480
United Oil Co.	400
Northern Exploration Co.	320
Union Oil Co.	320
Consolidated Mutual Oil Co.	280
Boston Pacific Oil Co.	160
Caribou Oil Co.	80
General Petroleum Co.	80
A. G. Wilkes	80
Record Oil Co.	40
Other	60
Total	8,160

ACREAGE COVERED BY SOUTHERN PACIFIC CASES.—The withdrawals did not affect the patented lands, the acreage of which is shown above in the various tabulations. The suits against the Southern Pacific Co. for the annulment of patents had virtually the same effect upon a large acreage of the patented lands, however, as the withdrawal suits had upon the unpatented withdrawn lands, as these suits stopped development in the Southern Pacific patented lands for a number of years. There was an agreement with the Southern Pacific Co. during the pendency of the suits that it would drill only offset wells.

The first of the Southern Pacific suits was brought in 1910, and by the middle of 1915 seven suits had been filed covering about 166,000 acres of patented land. This land included the alternate sections in the San Joaquin Valley oil fields, extending from about 10 miles north of Coalinga to about 10 miles south of Maricopa, with an estimated value in 1915 of $500,000,000. The suits involved all the land granted to the railroad by the Government. This land was withheld from development during the pendency of the suits, which were decided in the fall of 1919.

The Government won as to about 6,000 acres in naval reserve No. 1 and lost as to about 160,000 acres. The 6,000 acres thus remain withdrawn from development, but the 160,000 acres reverted to the Southern Pacific Co., which can now undertake intensive development if it so wishes.

ESTIMATED PETROLEUM CONTENTS.—It was stated at the hearing on oil-leasing lands before the House Committee on the Public Lands in 1918 that there were 700,000,000 barrels of crude petroleum in the 3,000,000 acres of withdrawn lands.[22] If this estimate is correct, then a large part of the oil in the withdrawn lands was in the naval reserve in California, as the Navy Department estimated in 1918 that there were over 450,000,000 barrels of crude petroleum in the two California naval reserves.[23] An official of the Geological Survey estimated in 1920 that in the 2–5 of naval reserve No. 2 and the 5–6 of naval reserve No. 1, the title to which will probably be retained by the Government, there were about 250,000,000 barrels of crude petroleum.

In 1916 the Secretary of the Interior estimated that the petroleum remaining in the ground in California amounted to 2,345,000,000 barrels.[24] Allowing for the crude petroleum produced since that date there would remain in 1920 about 2,000,000,000 barrels, so that the entire contents of the two naval reserves would be about 20 per cent of the total estimated petroleum deposits of the State, of which a little more than one-half was in land belonging to the Government in the two reserves, and therefore subject to the withdrawal orders. There is also, of course, a large quantity of petroleum deposits in the withdrawn lands belonging to the Government outside the naval reserves.

ESTIMATED VALUE OF LANDS.—It has been estimated that the withdrawn lands to which the Government still retains title had a market value in 1916 of not less than $150,000,000. The lands involved in the Southern Pacific suits were estimated to be worth over $500,000,000.

WELLS DRILLED ON WITHDRAWN LANDS.—Twenty-seven oil wells had been drilled in naval reserve No. 1 up to 1917. Of these wells three entered the oil sand but were shut down and not producing. On June 30, 1920, there were no producing oil wells on the unpatented land in this reserve. In 1916 there were said to be 315 producing wells in naval reserve No. 2, of which 175 were on patented land and 140 were on unpatented land. Of the 175 wells on patented lands 57 were on the Southern Pacific land, which was involved in the Government suits. On November 1, 1917, there were 322 producing wells in naval reserve No. 2, of which 221 were on patented land and 101 on unpatented land. Of the 221 on patented land 80 were on land involved in the Southern Pacific suits and 93 on lands of the Standard Oil Co. (California). On February 25, 1920, when the mineral land leasing bill was approved, there were 330 producing wells in naval reserve No. 2, of which 232 were on patented land and 98 on unpatented land. In 1919 the number of wells on the un-

[22] Hearings on oil leasing lands, House Committee on the Public Lands, 65th Cong., 2d sess., p. 217.
[23] The estimate of the Navy Department as of June 30, 1920, was 435,000,000 barrels for the two reserves. (Report Secretary of the Navy, 1920, p. 142.)
[24] Letter Secretary of the Interior, S. Doc. 310, 64th Cong., 1st sess., p. 17.

patented withdrawn land both inside and outside the naval reserves was said to be 653.

PRODUCTION FROM WITHDRAWN LANDS.—The contracts made by the Secretary of the Interior with producers under the act of August 25, 1914, covered unpatented land outside the naval reserves. The number of contracts, the average covered, and the production from lands under these contracts are shown in the following table:

TABLE 20.—*Crude petroleum produced on acreage under contract with the Secretary of the Interior, August, 1914–June 30, 1920.*

Date.	Contracts.	Area covered.	Production.
	Number.	*Acres.*	*Barrels.*
Up to June 30, 1917	48	4,160	2,963,143
Year ending June 30—			
1918	45	4,430	3,442,543
1919	40	4,165	1,864,972
1920	38	4,085	2,370,151
Total			10,640,809

The lands in the hands of the receiver under the suits by the Government are in the naval reserves. Up to June 30, 1917, there had been produced from these lands over 10,000,000 barrels of crude petroleum, and up to January 1, 1918, a total of 13,855,719 barrels. On January 30, 1920, there was over $22,000,000 in escrow under these suits, which would probably represent a total production of about 20,000,000 barrels of crude petroleum from these lands.

The total production of naval reserve No. 2 up to February, 1916, was approximately 41,800,000 barrels, of which 47 per cent, or 19,646,000 barrels, was from unpatented land. The production at that time was at the rate of 4,500,000 barrels per year. The production from naval reserve No. 2 from March 1, 1915, to October 1, 1916, was 9,600,000 barrels. The Southern Pacific was then producing 17 per cent of the crude petroleum in naval reserve No. 2 from patented land which was in litigation. The daily production of naval reserve No. 2 was 41,400 barrels in 1916. Up to November 1, 1917, the total production of this naval reserve was 72,000,000 barrels, and up to December 31, 1919, it was 91,600,000 barrels, with a value of $100,480,000. The production for the year ending December 31, 1919, was 9,800,000 barrels. In 1920 the 98 wells on unpatented land in naval reserve No. 2 were producing a total of 9,082 barrels of crude petroleum daily.

In 1918 the Southern Pacific Co. was operating 81 wells in naval reserve No. 2, which were producing 12,300 barrels per day. In the same year it was estimated that naval reserve No. 2 was producing 15 per cent of the monthly production of California. In 1919 the total production of California was about 101,000,000 barrels, while the production of naval reserve No. 2 was 9,800,000 barrels, so that its production was about 10 per cent of the total production of the State.

The importance of the withdrawn lands in California is indicated by the remarks made by Louis Titus, representing a number of

California oil operators, at a congressional committee hearing in 1918. Mr. Titus said:[25]

Why, in California we have more proven oil lands tied up in litigation with the United States Government than are known to exist in the whole State of Wyoming. We have more production on land that is tied up in litigation than the entire State of Wyoming produces at the present time; some of the very richest land in California—in fact, all of it that is tied up is very high class and highly productive oil land.

Figures compiled early in 1919 by the California State Mining Bureau showed that there were 19,745 acres of proven oil land in that State the titles to which were affected by the withdrawals. There were 653 wells on this land, and their total production up to that time amounted to over 76,000,000 barrels.

DISREGARD OF WITHDRAWAL ORDERS.—It would appear from the number of wells drilled and from the production on withdrawn lands, as shown above, that the withdrawal orders were very generally disregarded. A number of statements made before congressional committees, in trade papers, and elsewhere bear out this statement. In May, 1910, in response to a question as to what had been the result of the oil land withdrawals upon the oil business in California, T. A. O'Donnell, a representative of the California operators, replied:[26]

Surprising to say, it has not had a great deal of effect as yet.

A leading oil-trade journal in its issue of August 25, 1910, had the following comment in regard to operations on the withdrawn lands:[27]

Despairing of getting any satisfaction from Washington, it looks as though the big companies have decided to go ahead with the development and take out all the oil they can without applying for any patents, holding onto the land as long as the Government refrains from hoisting them by active legal proceedings or physical force. It is believed that they are convinced that it will be possible to carry on business for years in this way, and that in the end there is no real danger of their losing out.

The Attorney General, in his Annual Report for 1913, stated:[28]

These reservations (withdrawals) were very generally disregarded in California, also in Wyoming, and perhaps elsewhere.

At a hearing held in 1917, J. N. Gillett, representing the oil operators in California, in response to a question as to whether the withdrawal order of September 27, 1909, affected production, stated:[29]

No, because they continued to work right along on the development of wells and were spending millions of dollars; and only about three years ago they commenced shutting down. The Government permitted the wells to go on; wells were drilled and there was great activity for four or five years.

At a hearing held in 1916, Frank A. Short, representing California oil operators, stated that over $18,000,000 had been expended in the development of the withdrawn lands.

DRILLING OF WELLS PROHIBITED.—There were three classes of cases in which the drilling of new wells was prohibited except by permission of the Government. These were on lands covered by the Southern Pacific suits, the withdrawal suits, and the operating contracts. In the Southern Pacific cases over 160,000 acres of patented land were involved. In 1915 an agreement between the Government and the

[25] Hearings on oil leasing lands, House Committee on the Public Lands, 65th Cong., 2d sess., p. 776.
[26] Hearings on H. R. 24070, House Committee on the Public Lands, 61st Cong., 2d sess., p. 38.
[27] Oil and Gas Journal, p. 8.
[28] Annual Report U. S. Attorney General, 1920, p. 40.
[29] Hearings on leasing of oil lands, Senate Committee on Public Lands, 65th Cong., 1st sess., p. 25.

railroad virtually prohibited the drilling of any but defensive or offset wells, and these only to prevent the crude petroleum being drawn off by wells on the adjoining land. This prohibition to drill new wells lasted until the fall of 1919, when the suits against the Southern Pacific Co. were decided, the Government winning as to 6,000 acres and the Southern Pacific Co. winning as to some 160,000 acres.

In the withdrawal suits injunctions were secured in most cases against the drilling of new wells on the land involved. By 1917 over 13,000 acres of highly productive oil lands were involved in the withdrawal suits, most of which were under injunction against the drilling of new wells. From 1915 to 1920, inclusive, over 4,000 acres of producing oil lands in California were included in operating contracts with the Secretary of the Interior, under which further drilling was not allowed.

SHORTAGE IN SUPPLY.—There was an overproduction of crude petroleum in California from 1910 to 1915 and a shortage from 1916 to 1920. By overproduction is meant the production of more crude petroleum than is consumed for several consecutive years, and by shortage is meant the consumption of greater quantities than are produced for several consecutive years.

One of the reasons for the withdrawal of the oil lands in California was the overproduction of petroleum in that State in 1909. This overproduction continued through 1914. Part of the overproduction was caused by the rapid development on withdrawn lands in the effort to make discovery of crude petroleum and thus secure the right to a patent. But in 1915 a stop was put to the drilling of new wells on withdrawn lands through suits by the Attorney General and through the operating agreements by the Secretary of the Interior. Additional drilling of wells on a large area of patented land was also prevented, beginning in 1915, by suits against the Southern Pacific Co.

The reason the withdrawal of nearly all of the unpatented public oil lands in California did not prevent continued overproduction for several years after the withdrawal was made in 1909 was explained by a number of men appearing before the various congressional committees. Thomas A. O'Donnell, a prominent oil operator of California, in 1910, in answer to the question as to what had been the result of the oil-land withdrawal upon the oil business in California,[30] stated:

> Surprising to say, it has not had a great deal of effect as yet * * * because, perhaps 95 per cent of all work that is going on now was already started and they could not stop. They "had the bear by the tail" and could not let go; but there is very little new work, in my judgment, being contemplated until this matter is settled.

The matter was settled by the enactment of the Pickett Act in June, 1910, protecting claimants who were in "diligent prosecution of work leading to discovery." This requirement of the Pickett law, of course, increased drilling upon the withdrawn lands, as all claimants had to drill "diligently" to protect their claims. That the development of the withdrawn lands continued for several years after the withdrawal is shown by a statement made in 1917 by J. N. Gillett, who was a representative of the oil operators of California.

(See p. 83.)

[30] Hearings on oil land withdrawals, House Committee on the Public Lands, 61st Cong., 2d sess., p. 38.

Frank H. Short, another representative of the California oil operators, stated in 1916 that over $18,000,000 had been spent in the development of the unpatented withdrawn lands in dispute.[31] As very little had been expended prior to the withdrawal, it will be seen that there must have been very extensive development during the six years following the first withdrawal.

That the stopping of drilling by means of suits on large areas of unpatented lands and patented Southern Pacific lands in 1915 was one of the causes of the shortage of petroleum in California from 1917 to 1920 has been indicated in statements made by a number of Government officials, oil operators, and others. Lieut. Commander J. O. Richardson, of the Navy Department, stated in 1916 that if the leasing bill then before Congress was passed, thus opening up the withdrawn land to development, it would result in an increased production in California and possibly in a reduced price, and that in any case it would result in the crude petroleum being sold for less than its intrinsic worth, as had been done for the last two or three years.[32]

The following is quoted from the Oil and Gas Journal issue of November 2, 1916 (p. 21):

> The interference with drilling activities brought on by this withdrawal orders of the Government leaves many thousands of acres of territory still undecided as to its possibilities of maintaining a future supply of oil, for as far as the eye can see derricks erected miles apart and reaching out in every direction are awaiting the outcome of legislation.

The same journal contained the following in its issue of February 8, 1917 (p. 23), in regard to the shortage in production during 1916:

> The action of the Government in withdrawing the prolific oil lands of the San Joaquin Valley is directly responsible for the difference between production and consumption in the past year. It is argued by men who are familiar with the field that only for the check given active and anticipated developments—that is, had the locators of these claims been unhampered in drilling activities—there is no question of doubt but conditions for the past year would have been reversed, and at this time, instead of there being 13,000,000 barrels shortage, the surplus accumulated in the past few years would have been added to.

In July, 1917, the committee on petroleum of the California State Council of Defense published a very interesting and valuable report on the petroleum industry of California. In this report considerable space was devoted to the shortage of crude petroleum, the causes thereof, and the remedies therefor. The members of this committee were Max Thelen (chairman), Eliot Blackwelder, and D. M. Folsom. The report of the committee intimated that the shortage was due to the litigation with the Government and stated that there was no adequate remedy for the shortage except the development of the lands in litigation.[33]

The report of the committee, after stating that during 1916 and the first five months of 1917 consumption outran production at the rate of about 35,000 barrels per day, added:[34]

> In order to secure an increase of 35,000 barrels per day in the production of California petroleum, drilling must be done on the land which will yield the largest production in the shortest time.

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[31] Hearings on leasing of oil lands, Senate Committee on Public Lands, 64th Cong., 2d sess., p. 104.
[32] Ibid, 64th Cong., 2d sess., p. 218.
[33] Report of Committee on Petroleum, California Council of Defense, pp. 24, 230.
[34] Ibid. pp. 180, 185-186.

Of the most desirable undrilled lands, approximately 70 per cent are involved in litigation with the Federal Government. Nearly one-half of the best undrilled proven petroleum lands are claimed by the Kern Trading & Oil Co., the fuel-oil bureau of the Southern Pacific Co., under patents issued to the Southern Pacific Railroad Co. [35]

In another place the report of the committee stated: [36]

In our judgment, however, it is futile to expect an adequate increase from the lands which are at present free from suit, for it will be noted that the best of these lands have in general been more heavily drilled than any others, and at the same time they contain but a small part of the total acreage.

Again the committee stated in regard to the San Joaquin Valley oil lands then being withheld from development by Federal suits: [37]

It is our unqualified opinion that until these lands are in some way opened to rapid drilling, and for several months thereafter, a great increase in oil production can not be obtained from the valley fields.

The committee thought that production might be increased even if the naval reserves were maintained. Their report stated: [38]

We desire, however, to direct attention emphatically to the fact that a considerable portion of the proved productive territory hitherto undrilled is located outside of the naval reserves; that further development of most of this land has been stopped by litigation with the Federal Government; that the policy of the Federal Government which has resulted in the creation of naval reserves Nos. 1 and 2 can have no possible application to these lands which are not claimed or needed for the Navy; and that with the help of the Federal Government substantially increased production can be secured from these lands.

Bulletin 74 of the California State Mining Bureau, published in 1917, stated that the two prominent causes of the decline in production of petroleum were: (1) The tying up by Federal suits of the Midway-Sunset district that promised most from future development, and (2) the decline in the daily production per well in nearly all fields.

At a hearing before a congressional committee in 1917, Dr. Lyman Wilbur, president of Leland Stanford University, stated that when he was a member of the California State Council of Defense he asked the geological department of Leland Stanford University whether it was possible to increase the production of crude petroleum, and the answer was that the only possible immediate increase was by the development of well-proven oil territory in the State, which was in the naval reserves.[39]

M. L. Requa, then consulting engineer for the United States Bureau of Mines, stated at a hearing before a congressional committee in 1917: [40]

Due to the withdrawal of certain lands and the refusal of the Government to permit operations upon those lands, coupled with the normal decline of the fields, there came about an acute shortage, rendered more so by the increasing demand for oil. Stocks of oil have been steadily decreasing during 1916 and 1917.

A. C. Dieriex, president of the Honolulu Consolidated Oil Co., stated before a congressional committee in 1918 that his company had 4,800 acres of oil land in litigation, which had comparatively few wells, and that if they were allowed to lease their full claim they

[35] All of the lands patented to the Southern Pacific Co. under the railroad grants were involved in the litigation.
[36] Report of Committee on Petroleum, California Council of Defense, 1917, p. 142.
[37] Report Committee on Petroleum, California Council of Defense, 1917, p. 130.
[38] Ibid, 1917, pp. 186-187.
[39] Hearings on leasing of oil lands, Senate Committee on Public Lands, 65th Cong., 1st sess., p. 98.
[40] Ibid., p. 72.

would start an intensive drilling campaign and increase production at the rate of about 3,500,000 barrels a year, which would take care of one-third of the California shortage.[41]

At the same hearing A. C. McLaughlin, superintendent of operations of the fuel department of the Southern Pacific Co., stated that the Southern Pacific Co. was using 1,450,000 barrels of fuel oil per month, of which they produced 800,000 barrels from their own land, which was in litigation, and purchased 650,000 barrels from other companies. Mr. McLaughlin said that in April, 1917, the Southern Pacific Co. applied to the district court having jurisdiction of the cases against the company for permission to drill intensively on the litigated property in naval reserve No. 2, which would make up their deficit, but the court refused to permit this, as the Government desired to hold these lands as a permanent reserve.[42]

In March, 1920, K. R. Kingsbury, president of the Standard Oil Co. (California), in a letter to the Railroad Commission of California made the following statement in regard to the continued shortage of petroleum in California: [43]

> It is a matter of regret that the great area of productive lands, which has been held in litigation for so many years in the Midway field, was not opened to development and subjected to intensive operation.
> * * * The fact remains that a large body of productive land was allowed to remain idle and to suffer a great natural deterioration during a time of great necessity for oil, a policy largely responsible for the present shortage of fuel oil and the refined products of petroleum.

The withdrawals of oil lands and the shortage of crude petroleum production stimulated drilling operations outside of the withdrawn areas. As a result three new oil pools were discovered from 1917 to 1920, viz, the Montebello, Elk Hills, and Huntington Beach pools. The discovery well in the Montebello pool began producing in March, 1917, and at the end of 1919 this pool had produced more than 12,000,000 barrels. The Elk Hills pool and the Huntington Beach pool were brought in during 1920. The Elk Hills pool was producing more than 37,000 barrels per day in December, 1920, while the output of the Huntington Beach pool was 7,000 barrels per day early in 1921. All three of these pools were discovered by the Standard Oil Co. (California), and according to the Standard Oil Bulletin of February, 1921, neither of these last-named pools was "considered as having oil possibilities."

Summing up the effect of the withdrawals of oil lands upon the supply of petroleum in California and the probable effect of the enactment of the mineral land leasing law it may be stated:

(1) The withdrawals had only a slight effect in checking the development of oil lands in California for the first five years, as there continued to be an overproduction of crude petroleum in that State from 1910 to June, 1915. The withdrawal, therefore, did not adversely affect the California oil industry during that period, but was rather a means of preventing a greater overproduction than would have been the case had there been no withdrawal and lessened the waste due to storage to some extent.

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[41] Hearings on oil leasing lands, House Committee on the Public Lands, 65th Cong., 2d sess., pp. 707-708.
[42] Ibid., pp. 302-303.
[43] Standard Oil Bulletin, April, 1920, p. 3.

(2) The withdrawals, while not the only reason for the shortage of crude petroleum in California, did undoubtedly have considerable effect in lessening possible production during the period June, 1915, to 1920, inclusive. However, if there had been no withdrawals of oil lands in California there might have been a shortage anyway, because if the lands had been left open to mineral filings in 1909 they might have been pretty well drilled up during the period 1909–1915.

(3) The withdrawal of oil lands and the shortage of crude petroleum production stimulated drilling operations outside of the withdrawn lands, which led to the discovery of three new oil pools that were largely responsible for the record production of 1920.

(4) The enactment of the mineral land leasing law in February, 1920, and the final settlement of the Southern Pacific suits in the fall of 1919 are expected to lead to an increase in the annual production of crude petroleum in California, if there is no diminution in demand.

Chapter V.

ORGANIZATION, INVESTMENT, AND EARNINGS OF LARGE COMPANIES.

Section 1. Importance of large companies.

The Senate resolution directing this investigation named three large companies for which information covering their activities in all branches of the petroleum industry was to be made the subject of special inquiry; and this investigation has developed the fact that five large interests occupy a dominating position in the petroleum business of the Pacific coast. These five interests are highly integrated and are engaged in all branches of the oil industry, viz, producing, transporting, refining, and marketing; and their operations represent a very large proportion of the total volume of business in each branch of the oil business. These five interests in the order of the importance of their investment in all branches of the oil business of the Pacific coast in 1919 are as follows:

Standard Oil Co. (California).
Union Oil Co. of California.
Associated Oil Co.
Shell Co. of California.
General Petroleum Corporation.

In 1919 these interests produced over 53 per cent of the total gross production of the State, transported 90 per cent, and refined about 91 per cent of the total runs made by all the refineries in California.

In addition to these interests, the Doheny interests, which include eight producing companies; the Southern Pacific Co., which owns a majority of the stock of the Associated Oil Co., has been combined with it in the discussion of production; and the Atchison, Topeka & Santa Fe Railway Co., which controls two producing companies, are important factors in the ownership of oil lands and in the production of crude petroleum in California. The production of these seven interests in 1919 equaled almost 71.5 per cent of the gross production of the State.

Section 2. Standard Oil Co. (California).

Organization and development.—The Standard Oil Co. (California), which prior to the dissolution decree of the United States Supreme Court in 1911 was controlled by the Standard Oil Co. (New Jersey), was organized in September, 1906, as a consolidation of two concerns, the Standard Oil Co. (Iowa) and the Pacific Coast Oil Co.[1]

The Pacific Coast Oil Co. commenced business in 1879 with a capital stock of $1,000,000. It was one of the pioneers of the industry that was engaged both in the production and refining of crude petroleum in California. In 1900 the Standard Oil Co. (New Jersey) purchased the entire stock of the company, but it continued to operate under the name of the Pacific Coast Oil Co. until 1906.

[1] Report of the Commissioner of Corporations on the Petroleum Industry, Pt. I, p. 99.

The authorized and issued capital stock of the Standard Oil Co. (California) at the time of its organization was limited to $17,000,000. Common stock, through successive increases of its authorized capital stock had grown by 1919 to $100,000,000, of which $99,373,310 was recorded as outstanding on December 31, 1919. As compared with 1906, the outstanding capital stock of the company at the end of 1919 had increased by $82,373,310, of which $49,686,655 represents stock dividends issued in equal amounts in 1916 and 1917. The balance, amounting to $32,686,655 according to a statement furnished by the company, was subscribed in cash.

The Standard Oil Co. (California) has integrated in its organization all branches of the oil business from the production of crude oil to the distribution of the various refined petroleum products to the retailer and consumer. The different branches of the oil business are carried on by the company through specifically organized departments, without resorting to the instrumentality of forming or acquiring separate companies. A minor departure from this course was followed when the Standard Oil Co. (California) organized in 1917 the Richmond Petroleum Co. for the purpose of carrying on prospecting and wildcatting. In this respect there is a marked difference between the Standard Oil Co. (California) and the other large oil companies of California, all of which have to a varying degree followed the policy of expansion through corporate stockholdings.

PRODUCTION OF CRUDE PETROLEUM.—The Standard Oil Co. (California) has at the present time a larger crude-oil production than any other company in California. The growth in production of this company has been very rapid. In 1904 the Pacific Coast Oil Co. had producing properties valued at $271,200, from which it produced 120,000 barrels of crude oil, and, as already stated, the Standard Oil Co. (California) took over this property in 1906. By the end of 1919 the latter company's producing property had a book value of $112,080,185.17, and the year's production was 25,484,984 barrels, which represented over 25 per cent of the State's total of 101,221,784 barrels. In 1919 the company owned or leased 95,413 acres of oil land, of which 10,148 acres were proven area. During the same year 1,011 wells were operated.

The Standard Oil Co. (California) has been one of the leading companies in the development of new oil fields and in so-called wildcat operations. Among the important oil pools that it has discovered are the Montebello, Elk Hills, and Huntington Beach pools. In 1919 it drilled 108 new wells, of which 90 proved to be producing wells and 18 dry holes. The company's report for 1918 shows that while it produces oil in practically all of the oil fields of the State, 60 per cent of its production comes from the Whittier-Fullerton field, 25 per cent from the Midway-Sunset field, 6 per cent from the Coalinga field, and smaller percentages from Kern River, Lost Hills-Belridge, and the Ventura-Newhall fields, while its production from the Santa Maria field is almost negligible.

TRANSPORTATION FACILITIES.—The Standard Oil Co. (California) makes use of pipe lines, tank cars, and tank steamers to transport crude oil, while in the distribution of refined products, tank steamers, tank cars, and motor vehicles are employed. This company has very extensive investments in its transportation facilities and is the

most important factor in this branch of the petroleum industry of California.

The pipe-line system of the Standard Oil Co. (California) had its genesis in short lines constructed by the Pacific Coast Oil Co. in Ventura County, notably one from Pico Canyon to the refinery at Newhall, which lines were built in the early eighties; in 1902–3, shortly after the Standard Oil interests acquired control of this company, the large production developed in the Kern River field and its geographical isolation prompted the construction of an 8-inch pipe line, 280 miles in length, from this field to its refinery at Richmond on San Francisco Bay, and a branch line was laid to the Coalinga field. The pipe-line investment of this company amounted to $6,212,696 in 1904. Short lines were built in Ventura County which were extended to the coast. Later the San Joaquin Valley line to the Richmond refinery was doubled, and in 1907 extensions were laid to the Midway-Sunset field and to the Lost Hills-Belridge field in 1910. The following year a pipe line was built from the Whittier-Fullerton field to the new refinery at El Segundo. On December 31, 1919, there were 913 miles of trunk lines operated by this company with a daily capacity of 122,000 barrels and 323 miles of gathering lines, which represented an investment of $15,815,385.95.

In addition to its large investment in pipe lines the Standard Oil Co. (California) used about 1,500 tank cars, with a capacity of from 200 to 300 barrels per car. Tank steamers are also utilized for the transportation of both crude and refined products. Some of these steamers transport the crude in the coastwise trade, others are used for shipments to our insular possessions and to foreign countries. The company had 13 tank steamers with an aggregate capacity of 584,000 barrels. The investment in tank steamers, barges, launches, and other property used for transportation by water was $7,077,940.83 December 31, 1919.

The marketing department of this company delivers a large part of its refined petroleum products directly to the consumer through service stations. During 1919, in the distribution of the refined products to the domestic trade, 2,091 motor and horse-drawn vehicles were used, while the producing, refining, and other departments required 293 motor vehicles.

PETROLEUM REFINERIES.—The Pacific Coast Oil Co. erected a refinery at Alameda, Calif., in the early eighties, but in 1901 this plant was removed to Richmond, also on San Francisco Bay. The capacity of this plant in 1901 was 10,000 barrels of crude oil per day; since that time successive additions have increased its capacity to 60,000 barrels per day. This plant is a thoroughly modern one and was equipped with a battery of 10 Burton Process pressure stills in 1917. In 1911 the Standard Oil Co. (California) erected another refinery at El Segundo, on the coast in the vicinity of Los Angeles' to refine its large production from the Whittier-Fullerton field, which was becoming commercially important at that time. The estimated daily capacity is 35,500 barrels. The plant is located on the seashore, but owing to the absence of proper wharfage facilities at that point, marine shipments are made from San Pedro, on Los Angeles Harbor. This harbor is connected with the refinery by a triple pipe line. In 1912 a refining plant was erected at Bakersfield, Calif., in the Kern River field, with a daily capacity of 20,000 barrels. This

gives the company a daily refining capacity of 115,500 barrels, which represented a gross refinery investment of $30,594,907.07 on December 31, 1919.

This company follows the general rule of running all crude oil produced or purchased through one of the refineries before any part of it is classified and sold as residuum or fuel oil.

MARKETING EQUIPMENT.—The Standard Oil Co. (California) sells its products in the marketing area formerly assigned to the Standard Oil Co. (Iowa), viz, California, Oregon, Washington, Arizona, Nevada, and a small part of Idaho, together with certain coastwise and overseas trade which can be cheaply and conveniently reached by tank steamers from California ports. The refined products and fuel oil are sold to retailers and consumers; over 50 per cent of the gasoline and 60 per cent of the kerosene is sold to retailers. The marketing facilities consists of 16 sales agencies, 385 substations, and 220 service stations. In 1919 the investment in marketing facilities and equipment amounted to $15,148,946.05.

TOTAL INVESTMENT.—The Standard Oil Co. (California) has a larger investment in the petroleum business of the Pacific coast than any other company or interest operating in that territory. The company's balance sheets for the period 1914–June 30, 1919, are shown in Appendix Table 13:

From other sources it has been ascertained that the Pacific Coast Oil Co. had a fixed investment of $9,045,450 in December, 1904, of which $2,119,550 was in the refinery, $271,210 in producing property, and $6,212,695 in pipe lines. The capital stock of the Standard Oil Co. (California) was increased from $49,687,000 in 1914 to $74,530,000 in 1916, with a further increase to $99,373,000 in 1917, while no additions were made during 1918 or 1919. The surplus in 1914 was $39,469,000; it was increased the following year to $43,201,000. Stock dividends amounting to $24,843,000 in 1916, and the same amount in 1917 was declared, and the surplus was $47,479,000 at the end of 1917. In 1918 the surplus declined slightly to $46,575,000, while on December 31, 1919, it had increased to $70,930,000.

The fixed investment including all departments of the business was $74,777,000 in 1914. During 1915 the fixed investment increased slightly to $78,565,000. During the subsequent years there was a continuous and rapid expansion of the fixed investment from $88,400,000 in 1916 to $182,142,000 at the end of 1919. This increase for the period 1917–1919 included certain appreciations which amounted to $62,365, 000 at the end of 1919. All of this appreciation was in the valuation of the producing property.

FIXED INVESTMENT BY DEPARTMENTS.—The details of the expansion in the fixed investment are shown in Appendix Table 14 for the period 1914–June 30, 1919. The fixed investment reported by the company for December 31, 1919, included $30,584,000 in refining, $15,148,000 in marketing, $112,080,000 in producing, $15,815,000 in pipe lines, $7,077,000 in marine equipment and some sundry properties. As already stated, the valuation of the producing property includes an appreciation of $62,365,000, which is claimed under the regulations of the Internal Revenue Bureau and is termed the discovery value of the producing properties.

EARNINGS IN ENTIRE BUSINESS.—The Senate resolution calls for a report on the profits of the Standard Oil Co. (California) and certain

other large interests. The earnings obtained from all operations of this company from 1914 to June 30, 1919, as shown by the company's records, are given in Table 21, while a more detailed statement is presented in Appendix Table 15.

TABLE 21.—*Income account of the Standard Oil Co. (California), as shown by the company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916	1917	1918	1919 [1]
Gross sales of oil..	$38,663,469.87	$37,835,404.95	$55,434,659.24	$78,983,365.21	$101,992,572.24	$51,095,082.75
Oil burned.....	1,027,829.11	2,007,332.14	2,295,133.61	2,893,478.66	4,628,114.45	2,070,130.65
Total sales..	39,691,298.98	39,842,737.09	57,729,792.85	81,876,843.87	106,620,686.69	53,165,213.40
Profits:						
Oil sold.....	1,568,081.51	2,682,026.91	1,576,978.40	2,791,643.58	13,898,710.68	5,320,262.92
Crude.....	3,709,944.24	1,784,422.10	3,883,139.09	8,641,358.23	14,626,236.91	9,137,092.29
Pipe lines....	2,921,749.50	2,059,922.35	8,500,312.30	10,440,196.69	3,945,173.97	1,258,331.52
Marine operations.....	383,737.80	1,174,734.46	688,900.88	484,677.50	1,865,319.40	880,793.23
Other.....	952,005.17	999,382,99	1,368,399.80	1,168,297.85	1,812,132.40	1,290,206.52
Total profits.	9,535,518.22	8,700,488.81	16,017,730.47	23,526,173.85	36,147,573.36	17,886,686,48

[1] First 6 months.

This company has no extensive holdings in subsidiary companies, and, as shown by the balance sheets, the investment in Government bonds constitutes the only outside investment which yields an income. The income from such sources is shown under "Interest and exchange" and is comparatively small.

RATE OF EARNINGS IN ENTIRE BUSINESS.—The rate of earnings on the entire investment—that is, capital stock, surplus and reserves, etc., combined—is shown in the following table:

TABLE 22.—*Rate of earnings of the Standard Oil Co. (California) in entire business, as shown by the company's records, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914.....	$91,405,859.01	$9,535,518.22	10.4
1915.....	92,271,770.64	8,700,488.81	9.4
1916.....	97,730,589.93	16,017,730.47	16.4
1917.....	127,627,845.24	23,526,173.85	18.4
1918.....	159,267,890.38	36,147,573.36	22.7
1919.....	165,418,817.16	[1] 17,886,686.48	21.6

[1] First 6 months.

This rate of earnings in 1914 has been computed on the net investment at the end of the year. For the succeeding years the rate of earnings is shown on the mean investment, which is obtained by taking one-half of the sum of the net investment at the beginning and end of the year. Thus determined, the rate of earnings, including all the activities of the company, varied from 10.4 per cent in 1914 to 21.6 per cent for the first six months, 1919, with an average rate of earnings of 17 per cent for the entire period.

INVESTMENT IN PETROLEUM BUSINESS.—The investment as shown by the balance sheets of the company includes certain outside invest-

ments which must be excluded in order to determine the investment in its oil business. Appendix Table 16 shows the net investment and the revised investment of the Standard Oil Co. (California) in the oil business only for the period 1914–June 30, 1919.

The company's total investment includes all capital items shown in the balance sheet, and from this amount such items as stocks and bonds of affiliated and other companies, which represent interest bearing securities and are not a part of the company's investment in its own operations, have been deducted in order to determine the company's net investment in the oil business. In the revised investment deferred charges and appreciation as shown by the company's records have been deducted, while certain adjustments in the depreciation and depletion charged on producing and refining properties have been made by the Commission in order to standardize the rates (see p. 119) for all companies. In addition, such items as incidental drilling, and geological and field research expenses have been regarded as additions to investment rather than deductions from income.

EARNINGS IN PETROLEUM BUSINESS.—The earnings and rate of earnings have been shown for the entire business of the company, and in order to determine the earnings from the company's operations in the oil business it is necessary to eliminate income from other sources, which includes such items as interest, dividends, and other outside earnings. The company's income from the oil business, as shown by its records, together with the income as revised by the Commission, is shown in Appendix Table 17. The items excluded are all plainly income from outside sources and not from the petroleum business.

RATE OF EARNINGS IN PETROLEUM BUSINESS.—The rate of earnings of the Standard Oil Co. (California) in the petroleum business for the period 1914–June 30, 1919, as shown by the company's records, is given in the following table:

TABLE 23.—*Rate of earnings of the Standard Oil Co. (California) in petroleum business, as shown by the company's records, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914	$91,325,859.01	$9,535,518.22	10.4
1915	92,182,085.96	8,700,488.81	9.4
1916	97,631,220.57	16,017,730.47	16.4
1917	126,634,608.86	23,423,720.80	18.5
1918	152,971,343.59	35,720,972.53	23.4
1919	157,285,710.39	[1] 17,700,521.22	22.5

[1] First 6 months.

The rate of earnings has been computed on the mean investment, excepting in 1914. The mean investment in the oil business has been determined by taking one-half of the sum of the investment at the beginning and end of the year; the net investment for 1914 is that shown for the end of the year.

The rate of earnings in the oil business increased from 10.4 per cent in 1914 to 22.5 per cent for the first 6 months, 1919. The year 1915 shows the lowest rate of earnings for the entire period, 9.4 per cent,

while the highest rate is 23.4 per cent in 1918. The average rate of earnings for the entire period in the oil business was 17.4 per cent.

REVISED RATE OF EARNINGS IN PETROLEUM BUSINESS. The Commission has made certain adjustments in the company's charges for depreciation and depletion in the presentation of the costs of producing and refining crude petroleum, and in computing the cost of producing crude petroleum other items such as charges for abandoned property and incidental drilling have been capitalized and added back to income. The revised rate of earnings as thus determined by the Commission is shown in the following table:

TABLE 24.—*Rate of earnings of the Standard Oil Co. (California) in petroleum business, as revised by the Commission, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914	$82,802,395.66	$10,088,951.04	12.2
1915	83,711,452.58	8,970,390.54	10.7
1916	89,582,948.98	17,431,270.03	19.5
1917	101,314,919.30	25,148,092.10	24.8
1918	113,711,898.80	38,760,093.53	34.1
1919	122,982,507.02	[1] 18,935,056.52	30.8

[1] First 6 months.

The mean investment has been obtained as shown before, while the earnings are presented in Appendix Table 17. The rate of earnings as shown by the Commission's revision is 12.2 per cent for 1914 and 30.8 per cent for the first six months, 1919, while the average for the entire period was 22.4 per cent. The lowest rate of earnings, 10.7 per cent, is shown for 1915, and the highest, 34.1 per cent, in 1918.

Section 3. Union Oil Co. of California.

ORGANIZATION AND DEVELOPMENT.—The Union Oil Co. of California was organized in October, 1890, with an authorized capital stock of $5,000,000, for the purpose of acquiring the properties of the Mission Transfer Co. and the Hardison & Stewart Oil Co. The latter two organizations came into existence in the early eighties and were among the pioneer producers of crude petroleum in the Ventura-Newhall field and the Pico Canyon district.

The Union Oil Co. of California has the second largest investment in the petroleum business of the Pacific coast and has grown to its present position not only through the expansion of the primary company but through the medium of acquiring control of separate companies that were engaged in the various branches of the petroleum industry. These subsidiary companies are geographically distributed so that the parent company has production in every important oil field in the State of California. According to the data on hand, the Union Oil Co., on December 31, 1919, had corporate holdings in the following companies which are engaged in the petroleum business:

California Coast Oil Co.
Casmalia Ranch Oil & Development Co.
Claremont Oil Co.
John Irwin Oil Co.

Lakeview Oil Co.
Los Angeles Oil Co.
National Products Co.
Syndicate Oil Co.

In addition to the above companies, which are directly identified with the petroleum industry of California, this company controls the following other companies:

California Domestic Water Co.
La Habra Water Co.
Ship Owners & Merchants Tugboat Co.
Southwestern Ore Co.
Outer Harbor Dock & Wharf Co.
Union Tool Co.

Special note is to be taken of the ownership exercised by the Union Oil Co. of California in the Producers Transportation Co. This company was organized in 1909 with a capital stock of $7,000,000 for the purpose of constructing a pipe line from the San Joaquin Valley to the coast at Port San Luis. At that time there were two pipe lines in that valley owned by the Standard Oil Co. (California) and the Associated Oil Co., respectively. The Producers Transportation Co. was organized through the combined efforts of the Union Oil Co. and the Independent Oil Producers' Agency, the latter being an organization that was formed in 1904 by many small producers, all of whom operated at that time in the San Joaquin Valley. The particular nature of this organization is discussed in Part II.

Up to June, 1917, the Union Oil Co. owned 71 per cent of the total outstanding stock of the Producers Transportation Co., and at that time submitted an offer to the minority stockholders to exchange their shares for stock of the Union Oil Co. on a share-for-share basis. This offer was accepted and the Union Oil Co. has thus come into sole ownership of the Producers Transportation Co.

The community of interests between the Union Oil Co. of California and the Independent Oil Producers' Agency has not been limited to their joint ownership of the Producers Transportation Co., for in 1910 an agreement was entered into whereby the entire output of the members of the Independent Oil Producers' Agency was to be disposed of to the Union Oil Co. for a period of 10 years. This contract still exists with minor modifications.

Through successive increases the authorized capital stock of the company had grown by 1907 to $50,000,000, of which only $7,897,400 was outstanding in that year. But stock continued to be issued every year, and at the end of 1919 the company reported to have outstanding $46,341,800, of which $19,745,993 was issued some time ago as stock dividend following an appraisal of the company's property.

An interesting feature in connection with the stock distribution of the Union Oil Co. of California is the fact that the Union Oil Co. (Delaware) had acquired 130,869 shares out of a total of 500,000 outstanding up to December, 1920. The Union Co. (Delaware) was organized on August 15, 1919, with a capital stock of 5,000,000 shares of no par value. This company is interested in the production and refining of oil through the ownership of a considerable number of companies in various oil fields of the country. In California its holdings include, besides the 26.2 per cent stock ownership in the Union

Oil Co. of California, the entire ownership of the Columbia Oil Producing Co. of California and of the Western Union Oil Co. The Columbia Oil Producing Co. has been credited with an annual gross production varying from 993,283 barrels in 1914 to 1,090,346 barrels in 1918.

PRODUCTION OF CRUDE PETROLEUM.—The Union Oil Co. acquired producing property in the Ventura-Newhall field from its predecessors and has always maintained an active interest in productive work. In 1904 it was operating in the Whittier-Fullerton, Santa Maria, and Coalinga fields, as well as extending its operations in the original Ventura-Newhall region. The cooperation with the Independent Oil Producers' Agency prevented any development of its own in the Kern River or McKittrick fields. In 1910 the Lakeview No. 1 gusher was drilled in the Midway-Sunset field by this company and Lakeview No. 2 was brought in during 1914.

At the present time this company either directly or through cooperation with other companies is operating in all of the oil fields of California and is a very active "wildcatter." In 1919 the Union Oil Co. and subsidiaries owned or leased 286,417 acres of land, of which 12,512 acres are proven territory on which they operated 529 wells in December, 1919. Thirty-six wells and thirteen dry holes were drilled in 1919, while the total production for the same year was 8,705,447 barrels. The activities of this company in production have recently been extended to Wyoming, Texas, and Mexico.

TRANSPORTATION FACILITIES.—A pipe line which had been operated by the Mission Transfer Co. in Ventura County was obtained when this company was organized; this line was later extended through the Santa Clara Valley to the coast at Ventura. Pipe lines were also constructed throughout the Whittier-Fullerton fields, and were connected with the Los Angeles field and extended to the coast at San Pedro. The construction of the pipe line from San Joaquin Valley to the coast at Port San Luis in cooperation with the Independent Oil Producers' Agency was completed in 1910, while Lakeview No. 1 gusher was still flowing, and a pipe line was also laid which extended to Port San Luis from the Santa Maria field. These pipe lines reached all the fields in which the company was interested and formed a very efficient system for the transportation of crude petroleum.

In 1919 the trunk pipe lines owned or controlled by this company aggregated 421 miles, with a daily capacity of 95,000 barrels. Other transportation facilities include 18 tank steamers and barges, with a capacity of 528,000 barrels, besides chartered ships, tank cars, tank wagons, and motor vehicles.

PETROLEUM REFINERIES.—The original refinery of this company was located at Santa Paula in Ventura County, but in 1895 a new refinery was erected at Oleum on San Francisco Bay, which in 1920 had a daily capacity of 22,000 barrels. Other refineries operated by this company were built at Bakersfield (Maltha) in 1903, at Avila in 1910, at Fullerton (Brea) in 1911, at Santa Paula in 1912, and at Los Angeles in 1919. The combined daily capacity of all these plants is 64,800 barrels.

MARKETING EQUIPMENT.—This company is thoroughly integrated and has adopted the retail marketing system in the domestic market, and thereby eliminating wholesalers and brokers in the distribu-

tion of its petroleum products. Its domestic marketing territory includes the Pacific Coast States with Nevada and Arizona, in which it operates 22 service stations. The Union Oil Co. of California is engaged in trade with the insular or noncontiguous territories of Hawaii and Alaska. The company also has a considerable export trade, particularly to British Columbia, Panama, and Chile. In connection with its activities in Mexico, crude oil from that country is purchased to supply contracts for fuel oil made with customers in Panama and Chile.

TOTAL INVESTMENT.—The Union Oil Co. of California has the second largest investment of all the large interests operating in California. The balance sheets as submitted by the company show a rapid growth in the company's investment during the last few years. Appendix Table 18 gives the balance sheet for the period 1914–June 30, 1919.

The capital stock and outstanding bonds together aggregated $41,985,000 in 1914, $42,094,000 in 1915, and $42,703,000 in 1916. A marked increase occurred in 1917, when the amount was $51,198,000. This was followed by more moderate additions in 1918 and 1919, when the amounts were $54,898,000 and $56,886,000, respectively. The surplus in 1914 was $11,788,000; in 1915, $11,617,000. The improved conditions in the petroleum business during the following years is reflected in the company's surplus, which was $16,561,000 at the end of 1916, $21,237,000 December 31, 1917, while at the end of the following year it declined to $19,326,000 and then increased to $25,282,000 on December 31, 1919. The fixed investment in the plant and properties was $43,528,000 in 1914, $44,512,000 in 1915, and $46,015,000 in 1916. There was a marked increase in 1917, at which time the pipe line property of the Producers Transportation Co. was taken over, resulting in increasing the fixed investment to $63,919,000, while smaller increments were added in the following years, giving $70,513,000 and $73,191,000 in 1918 and 1919, respectively.

FIXED INVESTMENT BY DEPARTMENTS.—Appendix Table 19 gives the analysis of the fixed investment by departments and shows clearly the progress of the company.

The fixed investment in 1919 included refinery property valued at $7,198,000, marketing investment of $8,080,000, a valuation of $42,139,000 for producing property, which includes an appreciation item of $8,605,000, pipe-line investment of $10,634,000, and $5,138,000 in marine equipment.

EARNINGS IN ENTIRE BUSINESS.—The profits of the Union Oil Co. of California are especially mentioned as a subject of inquiry in the Senate resolution, in response to which this report is submitted. The company's earnings from all of its activities, as shown by its records, are given in Table 25, while a more detailed statement is shown in Appendix Table 20.

TABLE 25.—*Income account of the Union Oil Co. of California, as shown by the company's records, 1914–June 30, 1919.*

Items.	1914	1915	1916	1917	1918	1919 [1]
Gross sales of oil...	$10,036,621.68	$19,248,143.15	$27,757,395.67	$33,911,301.32	$42,952,542.53	$26,084,356.34
Profits:						
Refined products.....	1,048,439.75	605,248.24	1,652,807.39	2,059,596.36	1,540,482.93	2,202,808.57
Crude sold....	722,623.08	623,217.87	2,679,770.89	4,287,244.17	4,771,532.95	3,053,519.84
Pipe lines.....	274,912.98	202,199.24	272,681.08	81,704.44	687,267.95	377,923.64
Marine operations.....	932,903.98	1,195,855.42	1,493,205.85	1,751,098.57	834,985.13	[2] 177,654.48
Other.....	[2] 243,395.36	192,608.41	1,126,098.47	[2] 537,359.41	[2] 1,811,129.71	114,114.82
Total profits.	2,735,524.43	2,819,129.18	7,224,563.65	7,612,284.13	6,023,139.25	5,570,712.39

[1] First 6 months. [2] Loss.

The company revised its 1918 income account in 1920 by changing the amount of depletion charged in accordance with regulations of the Bureau of Internal Revenue. The revised income amounted to $5,635,076.40, which is $388,062.85 less than the income shown in the table.

RATE OF EARNINGS IN ENTIRE BUSINESS.—The rate of earnings in the entire business, as shown by the company's records before the revision was made for the period, is shown in the following table:

TABLE 26.—*Rate of earnings of Union Oil Co. of California in entire business, as shown by the company's records, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.[1]	Annual rate of earnings.
			Per cent.
1914.....	$57,759,287.34	$2,735,524.43	4.7
1915.....	56,998,876.78	2,819,129.18	4.9
1916.....	58,984,310.18	7,281,597.87	12.3
1917.....	67,658,296.96	8,923,981.00	13.2
1918.....	74,201,323.53	7,573,139.25	10.2
1919.....	76,250,448.10	[2] 5,570,712.39	14.6

[1] Appendix Table 22. [2] First 6 months.

The net investment was determined by adding the capital stock, funded debt, and surplus. The rate of earnings for 1914 was computed on the net investment at the end of the year, while for subsequent years it was computed on the mean investment, which is obtained by taking one-half of the sum of the net investment at the beginning and end of the year. The rate of earnings, including all the activities of the company, varied from 4.7 per cent in 1914 to 14.6 per cent for the first six months of 1919, with an average rate of 9.9 per cent for the five and one-half year period. The years 1914 and 1915 show the lowest per cent of profit, while 1917 and the first half of 1919 were the most prosperous for this company.

INVESTMENT IN PETROLEUM BUSINESS.—The net investment as shown by the balance sheets of the company include certain items which must be excluded in order to show the investment in its oil business. Appendix Table 21 shows the investment of the Union Oil Co. of California in the oil business only for the period 1914–June 30,

1919. The company's total investment includes all capital items in the balance sheet, and from this amount such items as stocks, bonds, and notes in affiliated and other companies, which represent interest-bearing securities and are not a part of the company's investment in its own operations, are deducted in order to determine its net investment in the oil business. In the revised investment, deferred charges and appreciation, as shown by the company's records, have been deducted; also sundry adjustments have been made in depreciation and depletion in producing and refining properties made by the Commission (see p. 119) for all companies, while the item of incidental drilling has been capitalized instead of deducting it from income.

EARNINGS IN PETROLEUM BUSINESS.—The earnings and rate of earnings have been shown for the entire business of the company, and in order to determine the earnings from the company's operations in the oil business it is necessary to eliminate income from other sources, which includes such items as interest and dividends. The income from the oil business as shown by the company, together with the income as revised by the Commission, is shown in Appendix Table 22. The items excluded are all plainly income from outside sources and not from the petroleum business.

RATE OF EARNINGS IN PETROLEUM BUSINESS.—The company's rate of earnings in the petroleum business for the period 1914–June 30, 1919, is shown in the following table:

TABLE 27.—*Rate of earnings of the Union Oil Co. of California in petroleum business, as shown by the company's records, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914	$44,560,111.39	$2,158,589.64	4.8
1915	44,813,633.37	2,609,874.39	5.8
1916	47,437,915.44	6,120,927.42	12.9
1917	57,890,138.91	8,110,759.65	14.0
1918	67,620,068.35	7,878,569.93	11.7
1919	69,444,121.88	[1]5,550,678.71	16.0

[1] First 6 months.

The rate of earnings in the oil business varied from 4.8 per cent in 1914 to 16 per cent for the first six months of 1919, with several fluctuations in the intervening years, while the average rate of earnings for the entire period in the oil business was only 10.9 per cent.

REVISED RATE OF EARNINGS IN PETROLEUM BUSINESS.—The Commission has made certain adjustments in the company's charges for depreciation and depletion, because it adopted uniform rates for these charges in order to obtain a comparative basis for all these large companies, and for a similar reason other items, such as charges for abandoned property and incidental drilling, have been added back to the income. The revised rate of earnings as thus determined by the Commission is shown in the table following.

TABLE 28.—*Rate of earnings of the Union Oil Co. of California in petroleum business, as revised by the Commission, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914	$35,403,811.23	$1,810,206.51	5.1
1915	35,566,245.49	2,500,159.78	7.0
1916	38,119,190.89	6,173,082.22	16.2
1917	48,489,783.68	7,999,783.50	16.5
1918	58,325,317.66	8,347,442.93	14.3
1919	60,733,417.25	[1] 6,368,678.82	21.0

[1] First 6 months.

The net investment was obtained as before, while the earnings are those shown in Appendix Table 22. The rate of earnings varied from 5.1 per cent in 1914 to 21 per cent for the first six months of 1919, with minor fluctuations in the intervening years, while the average rate of revised earnings for the entire period was 13.5 per cent.

Section 4. Associated Oil Co.

ORGANIZATION AND DEVELOPMENT.—The Associated Oil Co. was incorporated in California in October, 1901, with an authorized capital of $40,000,000, all in common stock. All of the voting power was held by 11 trustees under a pooling arrangement. The amount of the authorized stock had not been increased up to December 31, 1919, and on that date $39,765,085 in common stock was outstanding. In 1909 the Southern Pacific Co. acquired control of the Associated Oil Co. through the purchase of $20,069,000 of the capital stock, and the pooling agreement whereby the stock was voted by 11 trustees was dissolved.

The Associated Oil Co. was formed by the consolidation of many small producing companies operating in such parts of the Kern River and McKittrick oil fields as were not accessible to the railroads. At the time this company was formed these fields had a surplus production of crude oil and the problem of providing adequate pipe-line facilities connecting with a railroad or running directly to the centers of consumption was very acute. The combination effected by the smaller producers in forming the Associated Oil Co. was an attempt to provide the necessary financial means to successfully overcome the handicap of inadequate pipe-line facilities. The first noteworthy acquisition of the Associated Oil Co. was its purchase, in 1905, of the pipe line that ran from Coalinga field to Monterey on Monterey Bay. In 1907 the Associated Oil Co., together with the Southern Pacific Co., organized the Associated Pipe Line Co. In addition to its interest in this pipe line, the Associated Oil Co. is interested in a number of subsidiary companies engaged in the various branches of the petroleum industry by either owning the entire outstanding stock of those companies or by holding a majority ownership in them. Some of these companies carry on development work and some manufacture and deal in oil supplies; however, most of the companies carry on extensive operations in the production of crude petroleum.

The following companies are controlled by or affiliated with the Associated Oil Co.:

Amalgamated Oil Co.
Arcturus Oil Co.
Associated Oil Co. of Nevada.
California Coast Oil Co.
California-Utah Oil Co.
Casmalia Syndicate.
Coalinga Unity Oil Co.
Commercial Petroleum Co.
New Hope Oil Co.
Pantheon Oil Co.
Pioneer-Midway Oil Co.
Reward Oil Co.
Salt Lake Oil Co.
Sterling Oil & Development Co.
West Coast Oil Co.

All of the companies listed above are producing companies except the Associated Oil Co. of Nevada, which is engaged in marketing. In addition to the above, the Associated Oil Co. owns or controls the following water and supply companies:

Associated Supply Co.
Associated Water Co.
Bakersfield Iron Works.
Western Mineral Co.

PRODUCTION OF CRUDE PETROLEUM.—The original stockholders in this company, which included many of the largest and best known producers in the State, had their holdings in the Kern River, McKittrick, and other fields in the San Joaquin Valley division, where the production was so prolific during the opening years of this century. Other early acquisitions included producing properties in the Santa Maria field in the coastal division, while in the southern division production was obtained through acquisition of an interest in the Amalgamated Oil Co., which company controlled production in the Salt Lake field adjacent to Los Angeles and through the acquisition of the Salt Lake Oil Co., the Arcturus Oil Co., and the California-Utah Oil Co. The Amalgamated Oil Co. later extended its operations to the Whittier-Fullerton field, while the Associated Oil Co. at the same time entered the Ventura County-Newhall fields. Producing operations are now conducted by this company in all producing areas in the State. The total acreage controlled by the company is 91,763, of which 48,835 acres were classified as proven area in 1918. The Associated Oil Co. had 1,239 producing wells in 1919, of which 75 were drilled during that year.

TRANSPORTATION FACILITIES.—In 1904 a 6-inch pipe line had been built from Coalinga field to the coast at Monterey on Monterey Bay by the California Coast Oil Co. This pipe line was purchased by the Associated Oil Co. in 1905. In 1907, in conjunction with the Southern Pacific Co., the Associated Pipe Line Co. was organized with a capitalization of $7,000,000. It immediately began the construction of a pipe line from the Kern River field to San Francisco Bay. This was an 8-inch line and was completed in 1908; upon its completion another pipe line was built from the McKittrick field through Coalinga field to the same terminal. In the meantime a pipe line, terminating at

Gaviota, had been acquired in the Santa Maria field, while the Amalgamated Co. had a short pipe line connecting the Salt Lake field with the city of Los Angeles. The company also owns 12 tank steamers, barges, tugs, etc., capacity 296,000 barrels, for use in the coastwise trade and around harbors. Other transportation facilities include tank cars and tank wagons.

PETROLEUM REFINERIES.—The refining facilities of this company include the Los Angeles plant of the Amalgamated Co., built in 1904, the plant at Gaviota acquired in 1906, and the refinery constructed at Avon on San Francisco Bay. These plants have an aggregate daily capacity of 42,000 barrels.

MARKETING EQUIPMENT.—The primary purpose of the operations of this company was to produce heavy crude petroleum for use as fuel on the locomotives of the Southern Pacific Co. In conformity with this purpose, the Associated Oil Co. make many exchanges of light oil for heavy crude with the other producing companies and also purchased fuel oil in the open market. However, as a result of its refining operations, the refined products are available for distribution and it is necessary for the company to maintain marketing facilities to handle these products. Its domestic marketing territory includes California, Oregon, Washington, Nevada, and Arizona. Shipments are also made to Alaska and Hawaii, and the company is engaged in foreign trade with British Columbia, Panama, and Colombia.

TOTAL INVESTMENT.—The Associated Oil Co., as already stated, is engaged in all branches of the oil business and it ranks third in investment in the petroleum business of California. The company's balance sheets for the period 1914–June 30, 1919, are shown in Appendix Table 23.

The capital stock and funded debt aggregated $54,970,000 in 1914 and $50,346,000 in 1919, with minor fluctuations during the intervening years. This company did not declare any stock dividends. The surplus was $6,273,000 in 1914, declined to $5,962,000 in 1915, and beginning with 1916 shows a steady increase to $12,504,000 in 1919. The fixed investment in plant and properties was $55,999,000 in 1914, and increased steadily throughout the period 1915–1919 by small increments to $66,273,000 in 1919.

FIXED INVESTMENT BY DEPARTMENTS.—The net plant investment of the Associated Oil Co., as shown in Appendix Table 23, includes the investment in producing property and equipment, in pipe lines, refineries, marine transportation equipment, marketing equipment, and miscellaneous investment. The net plant investment for these different activities is shown in Appendix Table 24.

The fixed investment by departments in 1919 included $2,224,000 in refining, $1,487,000 in marketing, $32,249,000 in producing, $6,531,000 in pipe lines, $1,914,000 in marine equipment, and $44,000 in miscellaneous properties.

EARNINGS IN ENTIRE BUSINESS.—The Senate resolution did not specifically mention by name the Associated Oil Co. as one of the companies for which a report on profits should be secured; however, the resolution requests such information on "other companies," and the Associated has the third largest investment in the petroleum business of the entire State of California. The earnings obtained from all of the operations of this company, as shown by the company's records, are given in Table 29.

TABLE 29.—*Income account of the Associated Oil Co., as shown by the company's records, 1914–June 30, 1919.*

	1914	1915	1916	1917	1918	1919[1]
Gross sales of oil...	$12,372,209.71	$12,535,424.27	$17,722,466.80	$24,591,678.28	$27,247,119.72	$14,205,127.90
Profits:						
Refined products.....	[2] 778,605.37	[2] 912,980.18	[2] 1,709,267.80	[2] 1,310,865.65	1,788,225.70	1,040,935.46
Crude sold.....	[2] 472,819.04	[2] 368,227.61	1,204,790.41	2,607,872.57	3,101,889.63	1,490,735.76
Pipe lines.....	2,073,758.85	2,723,902.47	2,532,524.92	1,915,271.24	1,059,685.56	404,645.40
Marine operations.....	212,302.32	371,988.94	892,228.90	857,712.76	1,392,827.18	463,018.70
Other.....	219,879.90	108,773.28	112,442.45	[2] 220,956.73	[2] 2,786,942.98	[2] 501,331.83
Total profits.	1,254,516.66	1,923,456.90	3,032,618.88	3,849,034.19	4,605,685.09	2,798,003.49

[1] First 6 months. [2] Loss.

The table shows a loss on the refined oil sold for the period 1914 to 1917, inclusive, while a profit is shown for 1918 and 1919. The crude petroleum transferred to the refineries is charged to the refineries at the market price plus transportation charges, and excepting the production department in 1914 and 1915, production, pipe lines, and the marine departments show profits. If these profits were deducted from the cost of sales a gain would be shown rather than a loss. The item "Other earnings" includes dividends and interest from affiliated companies and for recent years interest from Government bonds.

RATE OF EARNINGS IN ENTIRE BUSINESS.—The rate of earnings on the entire investment; that is, capital stock, bonds, and surplus combined, is shown in the following table:

TABLE 30.—*Rate of earnings of the Associated Oil Co. in entire business, as shown by the company's records, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.[2]	Annual rate of earnings.
			Per cent.
1914.....	$61,243,806.70	$1,265,589.40	2.1
1915.....	60,147,066.44	1,939,919.28	3.2
1916.....	58,886,587.03	3,112,890.82	5.3
1917.....	59,149,427.09	4,021,483.24	6.8
1918.....	59,787,718.44	7,410,228.66	12.4
1919.....	60,823,999.94	[1] 3,565,722.87	11.7

[1] First 6 months. [2] Appendix Table 27.

This rate of earnings has been computed on the net investment at the end of the year in 1914, while for subsequent years the rate of earnings is shown on the mean investment, which is obtained by taking one-half of the sum of the net investment at the beginning and end of the year. Thus determined, the rate of earnings including all the activities of the company varied from 2.1 per cent in 1914 to 11.7 per cent for the first six months of 1919, with an average rate of earnings of 6.5 per cent for the entire period.

INVESTMENT IN PETROLEUM BUSINESS.—The investment, as shown by the balance sheets of the company, includes certain outside investments which must be excluded in order to determine the investment in its petroleum business only. Appendix Table 26 shows the net and revised investment of the Associated Oil Co. in the oil business

only for the period 1914–June 30, 1919. The company's total investment includes all capital items in the balance sheet, and from this amount such items as stocks and bonds in affiliated and other companies, which represent interest-bearing securities and are not a part of the company's investment in its own operations, are deducted in order to determine the company's net investment in the petroleum business. In the revised investment deferred charges and appreciation as shown by the company have been deducted, while certain adjustments in the depreciation and depletion charged on producing and refining properties have been made by the Commission in order to standardize such charges for all companies (see p. 119), while incidental drilling is regarded as an addition to investment rather than a deduction from income.

EARNINGS IN PETROLEUM BUSINESS.—The earnings and rate of earnings have been shown for the entire business of the company, and in order to determine the earnings from the company's operations in the petroleum business it is necessary to eliminate income from other sources, which includes such items as dividends and interest. The income from the petroleum business as shown by the company's records together with the income as revised by the Commission is shown in Appendix Table 27. The items excluded are all plainly income from outside sources and not from the petroleum business.

RATE OF EARNINGS IN PETROLEUM BUSINESS.—The rate of earnings from the petroleum business for the period 1914–June 30, 1919, is shown in the following table:

TABLE 31.—*Rate of earnings of the Associated Oil Co. in petroleum business, as shown by the company's records, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914	$53,279,535.40	$1,503,862.78	2.8
1915	52,289,384.42	2,274,215.09	4.3
1916	51,184,658.95	3,364,307.46	6.6
1917	50,846,166.69	4,495,295.08	8.8
1918	49,714,902.43	7,924,053.60	15.9
1919	49,533,612.72	[1] 3,833,685.87	15.5

[1] First 6 months.

The rate of earnings for 1914 is based on the net investment at the end of the year while for subsequent years it is based on the mean investment, which is obtained by taking one-half of the net investment at the beginning and end of the year.

The rate of earnings in the petroleum business only varied from 2.8 per cent in 1914 to 15.5 per cent for the first 6 months of 1919, with several fluctuations in the intervening years, while the average rate of earnings for the entire period in the petroleum business was only 8.3 per cent.

REVISED RATE OF EARNINGS IN PETROLEUM BUSINESS.—The Commission has made certain adjustments in the company's charges for depreciation and depletion because it adopted uniform rates for these charges in order to obtain a comparable basis for all the large companies, and for similar reasons, other items, such as incidental drilling, have been added back to the income and the investment.

The revised rate of earnings as thus determined by the Commission is shown in the following table:

TABLE 32.—*Rate of earnings of the Associated Oil Co. in petroleum business, as revised by the Commission, 1914–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1914	$43,970,528.65	$1,557,498.00	3.5
1915	43,077,655.98	2,179,535.31	5.1
1916	42,311,297.87	3,497,821.35	8.3
1917	42,381,390.32	4,700,576.20	11.1
1918	43,018,917.15	8,349,981.88	19.4
1919	44,091,577.26	[1] 3,886,506.01	17.6

[1] First 6 months.

The revised rate of earnings varied from 3.5 per cent in 1914 to 17.6 per cent for the first six months, 1919, with minor fluctuations in the intervening years, while the average rate of revised earnings for the entire period was 10.2 per cent.

Section 5. General Petroleum Corporation.

ORGANIZATION AND DEVELOPMENT.—The predecessor of the General Petroleum Corporation was organized in March, 1910, in California under the name of the Esperanza Consolidated Oil Co., as a consolidation of the Esperanza Oil and Gas Co. and the Sybil Oil Co. In 1912 the name of the company was changed to General Petroleum Co., and in May, 1916, there was a reorganization and the present company was formed under the name of the General Petroleum Corporation.

The authorized capitalization of the General Petroleum Co. was $50,000,000, all in common stock, of which $36,068,700 was outstanding in May, 1916, when the company was reorganized as the General Petroleum Corporation. The total capital stock issued by the latter company at the date of its organization, both in common and preferred stock, amounted to $16,702,400. The issued stock has since been increased to $21,787,800, of which $17,241,331.25 is common stock.

The General Petroleum Corporation is interested in several companies engaged in the production of crude petroleum in California and it controls the General Pipe Line Co. through ownership of all of its stock. The General Pipe Line Co. was formed in 1912 with an authorized capitalization of $7,500,000, divided into two classes of stock, class A amounting to $2,000,000 and class B amounting to $5,500,000. The entire authorized capital stock was issued immediately upon the organization of the company, the class B stock being held for the General Petroleum Co. by the General Pipe Line Corporation of Maine, which was a holding company. The entire issue of class A stock was sold to outsiders. The General Petroleum Co. guaranteed the payment of 8 per cent on the class A stock, reserving to itself the option of buying it back at par within the next seven years. Later this option was exercised by the General Petroleum Corporation and it became the sole owner of all of the stock of the General Pipe Line Co., and the holding company was dissolved.

The General Petroleum Corporation is not as highly integrated as some of the other large oil companies which operate in California. It is directly engaged in producing and refining crude petroleum, and it produces and transports crude petroleum through its subsidiaries. Its marketing department does not distribute refined products directly to the consumer through service stations. Its marketing activities are confined to sales to large consumers and to the wholesale market.

PRODUCTION OF CRUDE PETROLEUM.—The predecessors of this company controlled producing property in the Midway-Sunset, Santa Maria, Lost Hills-Belridge, and Coalinga fields, and later developments included properties in the Whittier-Fullerton and Ventura County fields; thus the present operations extend to all of the important oil-producing fields in California, excepting the Kern River and McKittrick fields. In 1919 this company controlled 20,433 acres of oil land with 450 producing wells, which represented a book value of $19,969,920.31. The company has done a great deal of prospecting and wildcatting. In its wildcat operations it has drilled single wells costing $100,000, without finding any oil.

The General Petroleum Corporation is engaged in prospecting for crude petroleum in Wyoming and Texas and a subsidiary of this company has been operating in Mexico, where 24,500 acres of land are controlled.

TRANSPORTATION FACILITIES.—The General Petroleum Corporation does not own or operate pipe lines, but the General Pipe Line Co., which is entirely owned by the former company, owns and operates an 8-inch pipe line which runs south from the oil fields in the lower extremity of the San Joaquin Valley, crosses the Tehachapi range, reaches the refinery at Vernon and extends to San Pedro. This line has a branch from Lebec to Mojave on the line of the Santa Fe Railroad. The total length of this line is 212 miles. The section of this pipe line from the Midway-Sunset field to Mojave is utilized to a high percentage of its capacity, while the section from Lebec to Vernon (78 miles in length) was used very little during 1918 and 1919, as the oil for refining purposes at Vernon has been obtained from Montebello pool in the Whittier-Fullerton field.

Other transportation facilities which are owned by the General Petroleum Corporation include tugs, barges, tank cars, and motor vehicles.

PETROLEUM REFINERIES.—The refining operations include a plant at Vernon, adjacent to Los Angeles, and a topping plant at Olinda in the Whittier-Fullerton field. The distillates from the latter plant are transferred to the former to be rerun. The plant at Vernon has a capacity of 20,000 barrels per day, and it uses the Trumble process of distillation. Experiments have been made with a new process which the company calls "a synthetic process," by which it manufactures "synthetic" gasoline and mineral turpentine.

MARKETING EQUIPMENT.—In the marketing department the company does essentially a wholesale business. It does not own or operate service stations which sell to the retail trade or directly to the consumer. In the domestic market fuel oil is sold at wholesale in the Pacific Coast States and in Nevada and Arizona. Some fuel oil is also exported.

TOTAL INVESTMENT.—The General Petroleum Corporation ranks fourth in the amount of investment in the petroleum business of California. The company's balance sheets for the period 1916–June 30, 1919, are given in Appendix Table 28.

The capital stock and bonds of this company aggregated $17,605,000 in 1916, the first year of its operations; they were increased to $19,252,000 in 1917, followed by a slight decline in 1918 to $18,561,000, and then increased to $23,548,000 in 1919. The profit and loss surplus as distinguished from the capital surplus was $291,000 in 1916, it was increased to $2,396,000 in 1917, and to $4,373,000 in 1918, after which there was a decline to $4,011,000 in 1919.

The fixed investment in the plant and producing properties was $16,830,000 in 1916, the following year it increased to $20,783,000; in 1918 there was a comparatively small increase to $22,286,000, which was followed by a large increase in 1919 to $31,463,000.

FIXED INVESTMENT BY DEPARTMENTS.—The details of the expansion in the fixed investment is shown in the increase in the investment by the different branches of the industry. This investment in the different branches of the General Petroleum Corporation is shown in Appendix Table 29.

The fixed investment for the General Petroleum Corporation does not include the pipe-line investment, as the pipe lines belong to the General Pipe Line Co. However, as all of the stock of the latter company is owned by the former company, the fixed investment in pipe lines has been shown in the table in order to furnish a basis for a complete comparison with other companies.

The fixed investment December 31, 1919, was $19,969,000 in producing properties, $1,419,000 in refining, $1,074,000 in marketing facilities, $7,570,000 in pipe lines, $223,900 in marine equipment, and $1,205,000 in miscellaneous properties.

EARNINGS IN ENTIRE BUSINESS.—The General Petroleum Corporation is specifically mentioned in the Senate resolution directing this inquiry and a report on its earnings is part of the information requested. The earnings for the General Petroleum Corporation from all sources are shown in the following table, while a detailed statement is given in Appendix Table 30:

TABLE 33.—*Income account of the General Petroleum Corporation, as shown by the company's records, 1916–June 30, 1919.*

Item.	1916 [1]	1917	1918	1919 [2]
Gross sales of oil	$3,607,747.09	$13,520,017.52	$23,274,170.45	$9,070,716.07
Profits:				
Refined products	686,112.46	4,443,326.08	6,821,091.40	2,407,018.49
Marine operations	253,066.31	515,358.45	2,299,668.92	312,306.78
Other (net)	[3] 541,191.81	[3] 1,993,062.65	[3] 5,184,968.12	[3] 1,074,930.05
Total profits	397,986.96	2,965,621.88	3,935,792.20	1,644,395.22

[1] Last 6 months. [2] First 6 months. [3] Loss.

The income for 1916 represents the earnings for the last half of the year. The years 1917 and 1918 were by far the most profitable years for this company, while on June 30, 1919, the net income for the one-half year shows a slight decline.

RATE OF EARNINGS IN ENTIRE BUSINESS.—The rate of earnings on the entire investment, that is, capital stock, surplus, reserves and bonds combined, is shown in the following table:

TABLE 34.—*Rate of earnings of the General Petroleum Corporation in entire business, as shown by the company's records, 1916–June 30, 1919.*

Year.	Net investment.	Earnings.[1]	Annual rate of earnings.
			Per cent.
1916 [2]	$21,478,511.06	$397,986.96	3.8
1917	23,794,944.06	2,965,621.88	12.5
1918	27,261,405.22	6,726,179.19	24.7
1919 [3]	29,554,592.64	[4] 31,872.78	[4] .2

[1] Appendix Table 32. [2] Last 6 months. [3] Earnings for first 6 months. [4] Loss.

The earnings of the General Petroleum Corporation in 1916 represent six months' operation, while the rate has been computed on an annual basis. This rate of earnings has been computed on the net investment at the end of the year. For the succeeding years the rate of earnings is shown on the mean investment, which is obtained by taking one-half of the sum of the net investment at the beginning and end of the year. Thus determined, the rate of earnings, including all the activities of the company, varied from 3.8 per cent in 1916 to a loss of 0.2 per cent for the first 6 months, 1919, with an average rate of earnings of 13.2 per cent for the entire period.

INVESTMENT IN PETROLEUM BUSINESS.—The investment as shown by the balance sheets of the company includes certain outside investments which must be excluded in order to determine the investment in its petroleum business. Appendix Table 31 shows the net and revised investment of the General Petroleum Corporation in the petroleum business only for the period 1916–June 30, 1919.

The company's total investment includes all capital items in the balance sheet, and from this amount such items as stocks, bonds, and notes in affiliated and other companies, which represent interest-bearing securities and are not a part of the company's investment in its own operations, are deducted in order to determine the company's net investment in the petroleum business. In the revised investment deferred charges and appreciation as shown by the company have been deducted while certain adjustments in the depreciation and depletion charged on producing and refining properties have been made by the Commission in order to standardize such charges (see p. 119) for all companies, while incidental drilling, geological and field research, etc., are regarded as additions to investment rather than deductions from income.

EARNINGS IN PETROLEUM BUSINESS.—The earnings and rate of earnings have been shown for the entire business of the company, and in order to determine the earnings from the company's operations in the petroleum business it is necessary to eliminate income from other sources, which includes such items as interest and dividends. The income from the petroleum business, as shown by the company's records, together with the income, as revised by the Commission, is shown in Appendix Table 32. The items excluded are all plainly income from outside sources and not from the petroleum business.

RATE OF EARNINGS IN PETROLEUM BUSINESS.—The rate of earnings in the petroleum business for the period 1916–June 30, 1919, is shown in the following table:

TABLE 35.—*Rate of earnings of the General Petroleum Corporation in petroleum business, as shown by the company's records, 1916–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1916	$17,970,116.32	[1] $396,315.95	4.4
1917	19,924,193.74	3,007,859.77	15.1
1918	22,872,098.84	6,724,753.83	29.4
1919 [2]	24,361,988.74	[3] 57,958.78	[3].5

[1] Last 6 months. [2] Earnings for first 6 months. [3] Loss.

The investment for 1916 is for the end of the year, while that for other years is the mean investment, which is obtained by taking one-half of the sum of the investment at the beginning and end of the year.

The rate of earnings in the petroleum business only varied from 4.4 per cent in 1916 to a loss of 0.5 per cent for the first six months 1919, with several fluctuations in the intervening years, while the average rate of earnings for the entire period in the petroleum business only was 15.7 per cent.

REVISED RATE OF EARNINGS IN PETROLEUM BUSINESS.—The Commission has made certain adjustments in the company's charges for depreciation and depletion, because it adopted uniform rates for these charges in order to obtain a comparative basis for all these large companies, and for similar reasons other items, such as charges for abandoned property and incidental drilling have been added back to the income and the investment. The revised rate of earnings as thus determined by the Commission is shown in the following table:

TABLE 36.—*Rate of earnings of the General Petroleum Corporation in petroleum business, as revised by the Commission, 1916–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1916	$14,549,419.87	[1] $533,194.46	7.3
1917	16,619,665.15	3,777,316.84	22.7
1918	20,116,687.94	7,618,866.94	37.9
1919	22,632,623.68	[2] 1,619,202.88	14.3

[1] Last 6 months. [2] First 6 months.

The revised rate of earnings varied from 7.3 per cent in 1916 to 14.3 per cent for the first six months 1919, with minor fluctuations in the intervening years, while the average rate of revised earnings for the entire period was 24.5 per cent.

Section 6. Shell Co. of California.

ORGANIZATION AND DEVELOPMENT.—The Shell Co. of California is a subsidiary of the Royal Dutch Petroleum Co. and of the Shell Trans-

port & Trading Co., of The Hague and London. These parent companies are a combination of British and Dutch interests. The Royal Dutch-Shell interests control the Roxana Petroleum Corporation (of Oklahoma) and own the entire outstanding stock of the Shell Co. of California.

The Royal Dutch-Shell combination first became identified with the oil industry of California in 1913, when the Shell Transport & Trading Co., an organization which represents the English interests in the original combination, purchased the California Oilfields (Ltd.). The latter company was organized in 1901 and carried on extensive operations in the production of crude petroleum in the Coalinga field. The management of the properties thus acquired was assigned to the American Gasoline Co. (changed to Shell Co. of California (Inc.), in 1914), a company which was organized in 1912, in the State of New York, one year prior to the acquisition of the California Oilfields (Ltd.), by the Royal Dutch-Shell combination. The transportation facilities acquired from its predecessors were not adequate to handle the business of the new company, and in 1914 the Valley Pipe Line Co. was organized with an authorized capital stock of $10,000,000. In 1915 the Shell Co. of California (Inc.) was dissolved and the ownership and operation of the properties taken over by a California corporation under name of the Shell Co. of California. The Shell Co. of California held the entire outstanding stock of the Valley Pipe Line Co. up to January 1, 1918, at which time the latter company was dissolved and the property merged with the Shell Co. of California.

The authorized capital stock of the Shell Co. of California is $45,000,000, and there was outstanding on December 31, 1919, $33,535,575. The company reported that $16,223,700 of this stock was subscribed for in cash, the balance, $17,311,875, having been issued for property. As brought out above, the ownership of the stock of this company, as well as of the other companies that were absorbed by it, has always been concentrated in the hands of the Royal Dutch-Shell combination. It is therefore obvious that the property which is reported by the company as representing the equivalent for the issue of $17,311,875 worth of stock did not come into the ownership of the company from outside sources, but represents the value placed upon the property by the Royal Dutch-Shell interests in effecting the various reorganizations, as a result of which the Shell Co. of California acquired the ownership of the properties of the subsidiaries of the combination.

The Shell Co. of California, on December 31, 1919, owned the entire stock of the following subsidiaries:

Gold Shell Steamship Co.
New Orleans Refining Co.
Oilfields Cooperative Store.
Pearl Shell Steamship Co.
Silver Shell Steamship Co.
Washington Refining Co.

PRODUCTION OF CRUDE PETROLEUM.—The Shell Co. of California acquired the producing properties of the California Oilfields (Ltd.), which had been purchased by the Shell interests. The California Oilfields (Ltd.) began operating in the Coalinga field in 1901. The principal production of the Shell Co. of California still comes from

that field, while a very small proportion comes from a few wells in the Ventura County fields. At the close of 1919 the company controlled 9,474 acres of land of which 2,545 acres are proven property. On December 31, 1919, this company had 276 producing wells.

TRANSPORTATION FACILITIES.—The Shell Co. of California owned the capital stock of the Valley Pipe Line Co. On January 1, 1918, the Valley Pipe Line Co. was dissolved and its property merged with the Shell Co. of California. The Valley Pipe Line Co. constructed an 8-inch pipe line from the Coalinga field to San Francisco, a distance of 170 miles. This line was built during 1914 and 1915 and was first operated on August 1, 1915. It has a daily capacity of 30,000 barrels.

Other transportation facilities include tank steamers, controlled by this company, tank cars, tank wagons, and motor trucks. The Shell Co. maintains service stations from which it distributes petroleum products directly to the consumer.

PETROLEUM REFINERIES.—In the earlier years this company purchased its refined products from several small refineries in the vicinity of San Francisco. Later it built two refineries, one of which was completed in December, 1915, and the other in 1916. One of these refineries is located at Martinez on San Francisco Bay and the other in the Coalinga field. The daily capacity of these plants is 30,000 and 2,000 barrels, respectively. The former plant is a complete refinery, producing such products as gasoline, kerosene, gas and fuel oil, and lubricating oils; while the Coalinga refinery is essentially a topping plant, although it does treat and finish the gasoline and kerosene distillates.

MARKETING EQUIPMENT.—In the domestic market this company distributes its products in all the Pacific States, also in Nevada and Arizona, while shipments to noncontiguous territory of the United States are made to Alaska and Hawaii, and export trade is carried on with British Columbia, Chile, and other countries. In its domestic territory the company maintains 77 service stations, distributed throughout California, Washington, and Oregon, which deliver the products directly to the consumer, while the company has an investment of about $200,000 in foreign ports consisting chiefly of tanks and other terminal facilities.

TOTAL INVESTMENT.—The financial status of the Shell Co. of California as disclosed by its balance sheets for the period 1915–June 30, 1919, is shown in Appendix Table 33.

The capital stock of the Shell Co. of California was $25,000,000 in 1915, while the amount was increased to $33,535,575 in 1916 and continued at that figure during 1917, 1918, and 1919. The earned surplus was $27,600 in 1915, $541,000 in 1916, and $747,000 in 1917, while the prosperous years of 1918 and 1919 showed a surplus of $3,484,000 and $5,437,000, respectively.

The fixed investment in plant and properties amounted to $21,391,000 in 1915 and $24,779,000 in 1916. Expansions of the company's business in 1917 caused a marked increase in the investment, which was $30,300,000 at the end of this year, while there was a further increase to $33,011,000 in 1918, and $35,280,000 in 1919.

FIXED INVESTMENT BY DEPARTMENTS.—The details of the company's fixed investment show the importance of the developments

in the different departments of the petroleum industry and the growth by departments from year to year. Appendix Table 34 shows the investment in the respective departments for the period 1915–1919. On December 31, 1919, the fixed investment included $4,517,000 in refining property, $2,028,000 in marketing property and equipment, $25,194,000 in oil lands and producing property, $3,299,000 in pipe lines, and $1,239,000 in miscellaneous investments.

EARNINGS IN ENTIRE BUSINESS.—The earnings as shown by the company, covering the activities in production, transportation, including both pipe line and marine, refining and for both foreign and domestic marketing activities, are given in the following table, and a more detailed statement is shown in Appendix Table 35.

TABLE 37.—*Income account of the Shell Co. of California, as shown by the company's records, 1915–June 30, 1919.*

Item.	1915	1916	1917	1918	1919[1]
Gross sales of oil	$1,723,380.52	$7,180,907.20	$9,832,062.96	$15,567,174.62	$6,585,506.68
Profits:					
Refined products	[2] 214,820.57	532,429.78	413,402.52	1,311,284.62	911,871.55
Crude oil	41,765.95	5,677.48	19,370.22		
Pipe lines	46,404.69			1,028,000.53	400,633.92
Marine operations	183,700.00	1,497.87	406,654.67		
Other (net)	[2] 36,043.61	[2] 25,965.64	[2] 56,515.19	646,453.90	35,594.96
Total profits	21,006.46	513,639.49	782,912.22	2,985,689.05	1,347,600.43

[1] First 6 months. [2] Loss.

The earnings for 1915 were very small. In this year the principal activity of the company was in the marketing department. The year 1915 was one of low prices for petroleum products throughout the Pacific coast territory.

RATE OF EARNINGS IN ENTIRE BUSINESS.—The Shell Co. of California is not specifically mentioned in the Senate resolution as one of the companies for which a report is to be made concerning its profits, however, the evident intent of the resolution is to include it, as this company is extensively engaged in the various branches of the petroleum business. As this company was not organized until 1915, earnings can only be shown for the period 1915–June 30, 1919. The investment on which the rate of earnings has been computed includes the capital stock and surplus.

The following table shows the net investment, the earnings, and the rate of earnings for the Shell Co. of California for the period 1915–June 30, 1919:

TABLE 38.—*Rate of earnings of the Shell Co. of California in entire business, as shown by the company's records, 1915–June 30, 1919.*

Year.	Net investment.	Earnings.[1]	Annual rate of earnings.
			Per cent.
1915	$28,740,749.27	$21,006.26	0.1
1916	29,771,569.02	513,639.49	1.7
1917	32,557,678.24	917,962.89	2.8
1918	35,651,341.12	2,985,689.05	8.4
1919	36,778,147.31	[2] 1,347,600.43	7.3

[1] Appendix Table 37. [2] First 6 months.

The rate of earnings for 1914 has been computed on the net investment at the end of the year. For subsequent years the rate of earnings is computed on the mean investment, which is obtained by taking one-half of the sum of the net investment at the beginning and end of the year. Thus determined, the rate of earnings, including all the activities of the company, varied from one-tenth of 1 per cent in 1915 to 7.3 per cent for the first six months, 1919, with an average rate of earnings of 4 per cent for the four and one-half year period. The year 1918 shows the highest rate of earnings, 8.4 per cent.

INVESTMENT IN PETROLEUM BUSINESS.—The investment as shown by the balance sheets of the company include certain outside investments such as Government bonds and stock in affiliated companies, which must be excluded in order to show the investment in its petroleum business.

Appendix Table 36 shows the net and revised investment of the Shell Co. of California in the petroleum business only for the period 1915–June 30, 1919.

The company's total investment includes capital stock and surplus in the balance sheet and from this amount such items as stocks, bonds, and notes in affiliated and other companies, which represent interest-bearing securities and are not a part of the company's investment in its own operations in the petroleum business, have been deducted in order to determine the company's net investment in the petroleum business. In the revised investment, deferred charges and appreciation, as shown by the company, have been deducted.

EARNINGS IN PETROLEUM BUSINESS.—The earnings and rate of earnings have been shown for the entire business of the company, and in order to determine the net earnings from the company's operations in the oil business it is necessary to eliminate income from other sources, which includes such items as interest and dividends, also the marine income owned by subsidiaries and royalty. The income from the oil business as shown by the company, together with the income as revised by the Commission, is shown in Appendix Table 37. The items excluded are all plainly income from outside sources and not from the petroleum business.

The items revised by the Commission are principally the charges for depreciation and depletion on the producing and refining properties which were adjusted for all companies (see p. 119), together with sundry items, such as geological and investigational expense, abandoned property, and patent depreciation.

RATE OF EARNINGS IN PETROLEUM BUSINESS.—The company's net investment and earnings in the petroleum business and the rate of earnings on investment for the period 1915–June 30, 1919, are shown n the following table:

TABLE 39.—*Rate of earnings of the Shell Co. of California in the petroleum business, as shown by the company's records, 1915–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1915	$23,213,781.97	$17,791.58	0.1
1916	23,981,155.46	460,984.66	1.9
1917	25,502,251.40	173,814.92	.7
1918	26,557,872.56	2,413,962.24	9.1
1919	26,575,240.28	[1] 1,339,927.93	10.1

[1] First 6 months.

The investments shown are the mean investments for years 1916–June 30, 1919, and for 1915, the investment as at the end of the year. The rate of earnings in the petroleum business varied from one-tenth of 1 per cent in 1915 to 10.1 per cent for the first six months of 1919, with several fluctuations in the intervening years of the period, while the average rate of earnings for the entire period in the petroleum business only was 3.9 per cent. These earnings do not differ greatly from those shown for the entire business. (See Table 38.)

REVISED RATE OF EARNINGS IN PETROLEUM BUSINESS.—The Commission has made certain adjustments in the company's charges for depreciation and depletion because it adopted uniform rates for these charges in order to obtain a comparative basis for all these large companies; and for a similar reason other items, such as geological and investigational expense, together with abandoned property and patent depreciation, have been added back to the income. The rate of earnings on the revised net investment and revised earnings as thus determined by the Commission is shown in the following table:

TABLE 40.—*Rate of earnings of the Shell Co. of California in petroleum business, as revised by the Commission, 1915–June 30, 1919.*

Year.	Net investment.	Earnings.	Annual rate of earnings.
			Per cent.
1915	$22,359,994.26	[1] $708,355.97	[1] 3.2
1916	23,555,341.77	1,296,677 80	5.5
1917	26,022,401.16	3,411,318.89	13.1
1918	29,089,890.15	5,687,042.89	19.5
1919	31,113,038.64	[2] 2,403,764.17	15 5

[1] Loss. [2] First 6 months.

The net investment has been obtained as previously explained, while the earnings are those shown in Appendix Table 37.

The rate of earnings varied from a loss of 3.2 per cent in 1915 to a profit of 15.5 per cent for the first six months of 1919. The highest rate is shown for 1918, when it was 19.5 per cent, while the average rate of revised earnings for the entire period was 10.4 per cent.

Sec. 7. Recapitulation of revised earnings.

The revised rates of earnings from the petroleum business for the five large integrated companies operating in the Pacific coast territory have already been shown separately, and they have been summarized in the table below in order to facilitate a comparison of the different companies for each year of the entire period. The average rate of earnings for all companies and for each company for the entire period is also shown.

Table 41, below, shows that the operations of the Standard Oil Co. (California) from the petroleum business were generally more profitable than were those of any other company, while those of the Shell Co. of California were usually less profitable than the other companies. The years 1914 and 1915 were years by far the least profitable, while 1918 and the first half of 1919 were very profitable for all companies. The recapitulation of the rate of earnings for each company and the average rate for all the years is shown in the table following.

TABLE 41.—*Revised rate of earnings for five large companies in petroleum business, 1914–June 30, 1919.*

Company.	1914	1915	1916	1917	1918	1919.[1]	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent*	*Per cent.*	*Per cent.*
Standard Oil Co. (California)	12.2	10.7	19.5	24.8	34.1	30.8	22.4
Union Oil Co. of California	5.1	7.0	16.2	16.5	14.3	21.0	13.5
Associated Oil Co.	3.5	5.1	8.3	11.1	19.4	17.6	10.2
General Petroleum Corporation	.....	.....	[1]7.3	22.7	37.9	14.3	24.5
Shell Co. of California	.....	[2]3.2	5.5	13.1	19.5	15.5	10.1
Average for all companies	8.3	7.0	14.4	19.2	26.0	23.6	17.0

[1] First 6 months on annual basis. [2] Loss.

As already pointed out, the combined rate of earnings for all companies covered show moderate earnings in 1914, viz, 8.3 per cent, and a still lower rate, 7 per cent, in 1915. Beginning in 1916 the revised rate of earnings for all these companies was 14.4 per cent, which increased to 19.2 per cent in 1917. The effect of the higher prices of crude petroleum and refined petroleum products in 1918 is reflected in the combined rate of earnings of these companies, which was 26 per cent. There was a slight decline for the first six months of 1919, when an average of 23.6 per cent is shown. The general average for all the companies for the entire period was 17 per cent.

CHAPTER VI.

COSTS, INVESTMENT, AND EARNINGS IN CRUDE PETROLEUM PRODUCTION.

Section 1. Conditions of production.

GENERAL CONDITIONS.—Before taking up the subject of costs in detail, a brief explanation is necessary regarding the system under which oil-producing lands are held and operated. In the ordinary course of the business crude petroleum is produced on land owned in fee by the producer or on land held under lease. Those producers who drill and develop their own lands and pay all expenses of development and operation are the sole owners of the product, while those who have a contract of lease according to which they drill and operate the oil wells, pay all expenses of development and operation, and undertake to compensate the owner or lessor of the land by a payment in money or in crude petroleum based on the quantity produced, which is designated as royalty. In some cases the lessee is required to pay the owner or lessor of the land a specified amount or "bonus" for the lease, which is in addition to any royalty. Sometimes, also, the contract provides for the payment of a small rent which is effective until a producing well has been drilled. When crude petroleum is discovered in paying quantities the rent ceases and the owner or lessor receives his royalty on the quantity produced.

Most lease agreements provide that the lessor at his option shall be paid his royalty portion either in the crude petroleum itself or in cash, based upon the current market price. In some cases the royalty portion is purchased by the operating company, while in other cases it is purchased by one of the large crude petroleum marketing companies. A record is kept of the quantity run from each property, and usually at the end of the month a statement is furnished to the lessor. When the crude petroleum is purchased directly by one of the large marketing companies, this statement gives the date the crude petroleum was run into the pipe line, the quantity, the price per barrel, and total amount. Accompanying this statement the lessor and producer each receive a check in payment in proportion to their respective interests in the crude petroleum. Royalties paid by California producers reporting to the Commission were largely in kind and ranged from one-sixteenth to one-fourth of the gross quantity produced, the most common royalty being one-eighth.

GROSS AND NET PRODUCTION.—This situation as to ownership and operation makes it important for some purposes to distinguish between the gross and net production. The former represents the total quantity of merchantable crude petroleum produced, including the royalty portion, while the net production consists of the merchantable crude that goes to the producer after deducting the royalty portion. Where producers operate on their own land there is no difference in the gross and net barrelage, and the cost per barrel is the same. In the case of those operating on leased lands with a royalty in kind the gross and net barrelage and the costs per barrel necessarily differ, as

such operators pay all expenses of operation, although their receipts and profits are based upon the net product.

In Table 14, page 62, the total production for all companies reporting to the Commission is shown and comparison is made with the total production for the State. Table 42, below, gives only the production for the companies that are included in the consideration of costs:

TABLE 42.—*Crude petroleum produced by companies included in the consideration of costs, in barrels of 42 gallons, 1914–June 30, 1919.*

Year.	Number of companies.	Production.			Net oil.	Royalty oil.
		Gross.	Net.	Royalty.		
		Barrels.	*Barrels.*	*Barrels.*	*Per cent.*	*Per cent.*
1914	96	59,820,927	55,876,541	3,944,386	93.4	6.6
1915	107	55,206,341	51,523,964	3,682,377	93.3	6.7
1916	116	64,006,392	59,706,110	4,300,282	93.3	6.7
1917	131	74,805,152	69,186,457	5,618,695	92.5	7.5
1918	134	80,685,115	73,963,435	6,721,680	91.7	8.3
1919[1]	119	41,118,906	37,822,438	3,296,468	92.0	8.0
Total		375,642,833	348,078,945	27,563,888	92.7	7.3

[1] First 6 months.

This table shows for each year the number of producing companies that furnished sufficient information for the purpose of computing costs, together with the gross and net quantity of crude petroleum produced and the quantity of the royalty portion. It will be seen from the data that the proportion of the royalty portion ranged from about one-sixteenth to about one-twelfth. While there was a substantial increase in the total quantity of crude petroleum produced, the proportion of the net crude remained fairly constant, although in the last three years of the period there was a slight decrease accompanied by a corresponding increase in the percentage of royalty portion. This result was partly due to the increased production of some of the largest companies from leased lands and partly by the increase in the number of companies operating upon leased lands. Thus, out of the total number of companies covered in the different years, in 1914 there were 44 companies operating upon leased lands as compared with 69 companies in 1918 and 61 in 1919.

Section 2. Elements of cost of production.

Operating costs as computed by the Commission include all items of expense properly chargeable to the operation and maintenance of wells and producing property. In this report operating costs are segregated into four main divisions, namely, lifting expense, general and administrative expense, depreciation and depletion.

LIFTING EXPENSE.—Lifting expense includes the items relating directly to the cost of operating wells and raising the crude petroleum to the surface and running it into the producers' tank. This item is subdivided into operating labor, fuel and water, supplies, repairs, including cleaning out and redrilling, teaming and trucking and miscellaneous items.

GENERAL AND ADMINISTRATIVE EXPENSE.—General and administrative expense includes all items of a general character, such as salaries of officials and office force, office rent and supplies, property insur-

ance, legal expenses, and all other general items properly chargeable to the production of crude petroleum.

DEPRECIATION AND DEPLETION.—The items of depreciation and depletion are important elements of the cost of producing crude petroleum. There was no uniform method of treating these items by those engaged in producing crude petroleum in California. Depreciation being applicable to different classes of tangible property with respect to which the actual cost is a matter of record, little difficulty was experienced in determining rates which appear reasonable. On the other hand, the subject of depletion presented many difficulties. In the first place, the reports received from producing companies showed a wide variation in the method of handling depletion. Some companies included it with depreciation and charged off a specified amount per barrel of product. Others omitted both charges entirely. Many companies followed the regulations of the Treasury Department for taxation purposes, while others, including some of the very largest companies, adopted rates which they considered more consistent with their experience and which in the long run will meet the primary object of this important element of cost.

In arriving at the determination of the method of treating depreciation and depletion a careful study was first made of the methods adopted by companies submitting the most complete reports. This was followed by a critical examination and comparison of the production records for the California oil fields. As a result of this study and comparison it was finally decided that the most practical plan would be the adoption of a reasonable average rate based upon the original cost of the producing properties and equipment and what may be considered a highly probable average period of productivity for the oil lands, over which the allowance should extend until the full amount of investment would be finally charged off or recovered. The following rates were adopted: Depreciation on well equipment has been computed at 5 per cent per annum; all other producing equipment and fixed assets, at 10 per cent per annum, and depletion on the original cost of producing oil lands has been charged at the rate of 5 per cent per annum.

In reaching the final determination full consideration was given to the methods and results shown by companies whose reports bore evidence of careful accounting methods. Among the number, one of the oldest and largest companies states that it estimated the productive life of its producing property at 25 years, and therefore it had fixed its charge for depletion, based on original cost, at 4 per cent per annum. Another company that produced more than 5,000,000 barrels of crude petroleum annually reported depletion charges on a barrel basis which in only one year exceeded 5 per cent on original cost, the average for the period being about 3.5 per cent. A third company producing more than 5,000,000 barrels of crude petroleum in 1919 charged depletion on a barrel basis which amounted to less than 5 per cent on original cost in that year, while its average for the period under consideration was about 5.4 per cent. The average rate for these three companies in 1919 was about 4.3 per cent. While the rate of 5 per cent adopted by the Commission may appear a little too large in comparison with the actual accounting of some of the largest and most successful producing companies, it

makes a reasonable allowance for the fact that some companies require a slightly higher rate.

CREDITS TO COSTS.—In California practically all operations for natural gas are conducted in conjunction with the production of crude petroleum and the cost incurred in such production has been included with that for crude petroleum. Therefore, for the purpose of this report, the income from natural gas is considered incidental to the crude petroleum producing business, and as the costs incurred in its production were included with those for crude petroleum, the income therefrom has been credited to the cost of production. Raw casing-head gasoline being a by-product which is produced simultaneously with crude petroleum, the net receipts from this source are considered a proper credit to the cost of producing the crude petroleum itself, but owing to the methods employed in handling this product in the California oil fields it is impracticable to secure satisfactory data concerning it, and no credits for casing-head gasoline, therefore, have been made to the cost of producing crude petroleum.

ROYALTY.—The most common practice of royalty charge in California appears to be a definite share of the crude petroleum produced, but often the lessor is given the option to take either his share of the crude or to receive its value at the current price. Even where the terms of the royalty contract provide for payment in kind the operator generally buys the crude at the market price. In practice, therefore, it makes little or no difference to the lessor how the terms of the contract are drawn in this particular so far as the amount he receives is concerned, nor to the operator with respect to taking the oil and the amount he pays for it. It does make a difference, however, in cost accounting theory and its correct practical application. It is quite likely under the circumstances that often neither the lessor nor the lessee have any definite understanding on an option arrangement whether the money is paid on the royalty contract or as a purchase price for the crude petroleum, and to get the details on this matter for the various lessors of each company for each year under the circumstances would be well nigh impossible. The Commission has, therefore, taken the royalty payments on the basis reported by the companies. Most companies did not show a money charge for royalty but merely the quantity of royalty oil from which the royalty charge was computed on the basis of the cost of production. A few companies reported money royalties only or both money royalties and royalties in kind.

EXPENDITURES DISALLOWED.—In order to present more accurate costs and to secure greater comparability between the costs for the different companies the Commission has made certain revisions in the figures as shown by reports obtained from the companies. Some companies included in their costs certain items which should have been capitalized, such as drilling costs and expenses incurred in the acquisition and development of oil properties. In some cases the expense of nonproductive drilling and interest on short-term notes were included in producing costs; these items have been charged directly to profit and loss. Other items taken out of cost, such as abandoned wells, canceled and surrendered leases, and Federal income and excess profits taxes, also bond interest, bonuses amounting to a distribution of profits, and stock discounts have been charged to the surplus account.

COMPANIES COVERED.—As already stated, some of the schedules obtained from companies engaged in producing crude petroleum were not sufficiently complete for use in computing the cost of production. Only such reports which were reasonably satisfactory have been used in the determination of the costs of production, investments, and profits for crude petroleum producing companies. As shown in Table 42, the smallest number of companies submitting satisfactory reports was 96 in 1914 and the largest was 134 in 1918. The production of companies which are used in the costs presented in this chapter represent the major portion of the total annual production in California. In 1914 the companies included produced 57.7 per cent of the State's total, in 1915 those included in costs produced 61.6 per cent, in 1916 the proportion increased to 69.7 per cent, the following year the percentage covered was 76.9 per cent, in 1918 it increased to 79.4 per cent, while in 1919, assuming the production for the first six months to be half of that for the year, the proportion would be 81.2 per cent.

PRODUCTION BY GROUPS.—The gross production of crude petroleum for the companies for which costs are shown have been placed in four groups as follows: Group 1 includes all companies which produced 1,000,000 barrels or over in each year; group 2 is made up of companies producing from 250,000 to 1,000,000 barrels; group 3 consists of companies having a production ranging from 50,000 to 250,000 barrels; while group 4 covers the companies producing less than 50,000 barrels each year. Under this grouping a company may be in group 1 in one year and in group 4 the next. This method of classifying the companies shows the effect of large output upon the cost of production. Table 43 shows the number of companies and the quantity and proportion produced by each group and the average production per company, in barrels, 1914–June 30, 1919:

TABLE 43.—*Production of crude petroleum, by groups of companies reporting, in barrels of 42 gallons, 1914–June 30, 1919.*

Year.	Group.	Range of production (in barrels).	Number of companies.	Quantity.		Percentage by groups.	Proportion of the State's total.
				Total.	Average per company.		
				Barrels.	*Barrels.*	*Per ct.*	*Per ct.*
1914	1	Over 1,000,000	10	45,942,546	4,594,255	76.8	44.3
	2	250,000 to 1,000,000	18	9,207,863	511,548	15.4	8.9
	3	50,000 to 250,000	38	3,802,888	100,076	6.4	3.7
	4	Under 50,000	30	867,630	28,921	1.4	.8
		Total	96	59,820,927	623,135	100.0	57.7
1915	1	Over 1,000,000	7	39,446,324	5,635,189	71.5	44.0
	2	250,000 to 1,000,000	20	10,572,668	528,633	19.1	11.8
	3	50,000 to 250,000	35	3,923,381	112,097	7.1	4.4
	4	Under 50,000	45	1,263,968	28,088	2.3	1.4
		Total	107	55,206,341	515,947	100.0	61.6
1916	1	Over 1,000,000	9	49,261,293	5,473,477	76.9	53.6
	2	250,000 to 1,000,000	19	8,879,891	467,363	13.9	9.7
	3	50,000 to 250,000	43	4,650,122	108,142	7.3	5.1
	4	Under 50,000	45	1,215,086	27,002	1.9	1.3
		Total	116	64,006,392	551,779	100.0	69.7
1917	1	Over 1,000,000	10	58,823,426	5,882,343	78.6	60.5
	2	250,000 to 1,000,000	19	9,255,178	487,115	12.4	9.5
	3	50,000 to 250,000	49	5,501,363	112,273	7.4	5.6
	4	Under 50,000	53	1,225,195	23,117	1.6	1.3
		Total	131	74,805,152	571,032	100.0	76.9

TABLE 43.—*Production of crude petroleum, by groups of companies reporting, in barrels of 42 gallons, 1914–June 30, 1919*—Continued.

Year.	Group.	Range of production (in barrels).	Number of companies.	Quantity.		Percentage by groups.	Proportion of the State's total.
				Total.	Average per company.		
				Barrels.	*Barrels.*	*Per ct.*	*Per ct.*
1918	1	Over 1,000,000	10	63,202,366	6,320,237	78.3	62.2
	2	250,000 to 1,000,000	22	10,541,776	479,172	13.1	10.4
	3	50,000 to 250,000	47	5,635,917	119,913	7.0	5.5
	4	Under 50,000	55	1,305,056	23,728	1.6	1.3
		Total	134	80,685,115	602,128	100.0	79.4
1919[1]	1	Over 1,000,000	11	33,383,864	3,034,897	81.2	66.0
	2	250,000 to 1,000,000	22	4,911,694	223,259	11.9	9.7
	3	50,000 to 250,000	39	2,254,639	57,811	5.5	4.4
	4	Under 50,000	47	568,709	12,100	1.4	1.1
		Total	119	41,118,906	345,537	100.0	81.2

[1] First 6 months. Percentages on annual basis.

In the above table, for the first half of 1919, the companies have been placed in groups on the assumption that their production for the entire year would be double that for the first six months.

The table gives the quantity of crude petroleum produced each year by the different groups, the average production per company, and the percentage of the total reported and the proportion of the State total which was produced by each group. The companies having the largest production, which are included in group 1, produced over 75 per cent of the total reported and from 44 to 66 per cent of the State total. For this group the highest percentage shown of that reported and of the total for the State was for the first six months of 1919, and the lowest in 1915. The number of companies producing 1,000,000 barrels or over per annum varied from 7 in 1915 to 11 in the first half of 1919, and the average per company varied from 4,594,255 barrels in 1914 to 6,320,237 barrels in 1918.

Group 2, which includes companies producing from 250,000 barrels to 1,000,000 annually, supplied a larger percentage of the State's total, 11.8 per cent, in 1915 than in any other year, while the smallest proportion, 8.9 per cent, was contributed by this group in 1914. The number of companies included in this group varied from 18 to 22. The average production per company varied from 223,259 barrels for the first half of 1919, on an annual basis, to 528,633 barrels in 1915.

Group 3 contributed only 3.7 per cent of the total production of the State during 1914, while its maximum was 5.6 per cent in 1917. The average production per company fluctuated from 100,076 barrels in 1914 to 119,913 barrels in 1918.

Group 4, which includes the companies having the smallest production in each year, contributed only 0.8 per cent of the total for the State in 1914, while its maximum was 1.4 per cent in 1915. While its production was very small, this group included from about 31 to 42 per cent of the total number of companies. The average per company for this group was larger during the first two years than in the latter part of the period. The highest average per company was in 1914, when it was 28,921 barrels, and the smallest for a full year in 1917, when it was only 23,117 barrels.

The average production per company for all companies reporting was higher in 1914 than in any other full year, and it was the smallest in 1915, but the first half of 1919 indicates a still larger average. In 1914 the average was 623,135 barrels and in 1915 only 515,947. This large decline was due to the fact that a number of large wells were brought in during 1914, which produced very little crude petroleum in 1915. One company that produced in excess of 1,000,000 barrels in 1914 produced less than 25,000 barrels in 1915.

Section 3. Cost of production.

TOTAL COST BY GROUPS.—As already stated, not all of the smaller producing companies furnished satisfactory information covering their cost of producing crude petroleum. In 1914 there were 125 companies that submitted reports showing the quantity of crude produced, while only 96 contained satisfactory cost data, and in 1918 there were 168 that reported production and only 134 that submitted satisfactory cost information. The companies have been placed in four groups, based on the quantity produced in each year. The following table shows the total cost of producing crude petroleum in California for all companies from whom satisfactory information was obtained, for the period 1914-June 30, 1919:

TABLE 44.—*Crude petroleum produced, the cost of production exclusive of royalty, and the total cost of production, as revised by the Commission, by groups, 1914–June 30, 1919.*

Year.	Group.	Range of production (in barrels).	Number of companies.	Quantity (barrels).	Cost exclusive of royalty.	Royalty cost.	Total cost.
1914	1	Over 1,000,000	10	45,942,546	$10,414,970	$849,937	$11,264,907
	2	250,000 to 1,000,000	18	9,207,863	2,424,605	209,018	2,633,623
	3	50,000 to 250,000	38	3,802,888	1,688,258	186,342	1,874,600
	4	Under 50,000	30	867,630	586,278	39,130	625,408
		Total	96	59,820,927	15,114,111	1,284,427	16,398,538
1915	1	Over 1,000,000	7	39,446,324	10,070,939	867,819	10,938,758
	2	250,000 to 1,000,000	20	10,572,668	2,635,953	171,277	2,807,230
	3	50,000 to 250,000	35	3,923,381	1,519,548	172,629	1,692,177
	4	Under 50,000	45	1,263,968	1,152,558	86,835	1,239,393
		Total	107	55,206,341	15,378,998	1,298,560	16,677,558
1916	1	Over 1,000,000	9	49,261,293	13,580,860	1,211,828	14,792,688
	2	250,000 to 1,000,000	19	8,879,891	2,717,470	198,022	2,915,492
	3	50,000 to 250,000	43	4,650,122	2,233,800	238,086	2,471,886
	4	Under 50,000	45	1,215,086	1,071,371	94,412	1,165,783
		Total	116	64,006,392	19,603,501	1,742,348	21,345,849
1917	1	Over 1,000,000	10	58,823,426	18,194,760	1,841,173	20,035,933
	2	250,000 to 1,000,000	19	9,255,173	3,142,291	$375,760	3,518,051
	3	50,000 to 250,000	49	5,501,353	3,139,036	285,520	3,424,556
	4	Under 50,000	53	1,225,195	1,217,743	119,211	1,336,954
		Total	131	74,805,152	25,693,830	2,621,664	28,315,494
1918	1	Over 1,000,000	10	63,202,366	21,660,693	2,420,651	24,081,344
	2	250,000 to 1,000,000	22	10,541,776	4,353,274	592,448	4,945,722
	3	50,000 to 250,000	47	5,635,917	3,546,371	344,918	3,891,289
	4	Under 50,000	55	1,305,056	1,426,254	128,157	1,554,411
		Total	134	80,685,115	30,986,592	3,486,174	34,472,766
1919[1]	1	Over 1,000,000	11	33,383,864	12,846,755	1,335,355	14,182,110
	2	250,000 to 1,000,000	22	4,911,694	2,228,641	221,517	2,450,158
	3	50,000 to 250,000	39	2,254,639	1,534,463	154,668	1,689,131
	4	Under 50,000	47	568,709	636,039	53,345	689,384
		Total	119	41,118,906	17,245,898	1,764,885	19,010,783

[1] First 6 months.

The above table indicates the importance of the crude petroleum producing business in California, which is covered by the tabulation. In 1914, the costs include 57.7 per cent of the total production of the State, the following year 61.6 per cent, in 1916 to 69.7, in 1917 the percentage increased to 76.9 per cent, in 1918 to 79.4 per cent, and the first six months of 1919 to 81.2 per cent. The quantities shown in the above table relate to the total production of merchantable crude petroleum for each year.

The amounts shown for the cost, exclusive of royalty, include lifting expense, general and administrative expense, depreciation and depletion, less credits due to the sale of natural gas. The amount shown for royalty covers both the cost of producing the royalty oil paid in kind and the amounts paid by the companies for the royalty portion which they were required to purchase. Costs by principal items are shown in Appendix Table 38.

COST PER BARREL.—The barrel of 42 gallons is the unit of measurement used by the oil industry in marketing crude petroleum, and it has been used in this report to show the unit cost of production in California. In presenting the per barrel cost of producing crude petroleum the detail has been restricted to four main divisions of expense—namely, lifting expense, general and administrative expense, depreciation, and depletion. The combined total of these items has been credited with the receipts from sales of natural gas, produced in connection with crude petroleum, and to this total is added the cost applicable to the royalty portion or other royalty cost which gives the cost to the operating companies. This method of computing the cost of production takes the actual cost applicable to the total quantity of crude petroleum produced for each of the main items, and at the same time gives the additional cost to the operating companies which is incurred by reason of the royalty that many producers were obliged to pay to a greater or lesser extent.

The causes for the advances in the prices of petroleum products, which are called for in the resolution directing this inquiry, reach back to the cost of producing the crude petroleum. But consideration of the cost of producing crude petroleum in relation to the prices requires more information than the average cost of production. An important part of the production is obtained at costs above the average cost of production, and the producers of this part, which to some extent, at least, is evidently a necessary part of the supply, must receive an adequate price, or such production will be discontinued; and this lessening of the total production would, if sufficiently large, tend to advance prices. In other words, it is important to set forth the costs of the less fortunate or less efficient producers. This does not mean, however, that the most extreme costs should be given any attention in the consideration of prices, as they are usually temporary factors and have little relation to supply and demand.

COST OF PRODUCTION BY GROUPS.—The companies from whom cost information was secured have been placed in four groups according to the quantity of their annual production. The first group includes all companies producing 1,000,000 barrels or over annually; group 2 covers those having an annual production of from 250,000 to 1,000,000 barrels; group 3 consists of companies having an output of from 50,000 to 250,000 barrels per year, while companies having less than 50,000 barrels production per year have been placed in group 4.

The following table shows the cost of producing crude petroleum per barrel, in California, by companies grouped as indicated above for the period 1914–June 30, 1919:

TABLE 45.—*Cost of producing crude petroleum, per barrel of 42 gallons, as computed by the Commission, by groups, 1914–June 30, 1919.*

Year.	Group.	Number of companies.	Lifting expense.	General and administrative.	Depreciation.	Depletion.	Credits.[1]	Cost exclusive of royalty.	Royalty.	Total cost.
1914	1	10	$0.049	$0.046	$0.067	$0.069	$0.004	$0.227	$0.018	$0.245
	2	18	.102	.033	.080	.049	.001	.263	.023	.286
	3	38	.171	.045	.107	.121	(2)	.444	.049	.493
	4	30	.240	.060	.183	.193	.....	.676	.045	.721
	Total	96	.068	.045	.073	.071	.004	.253	.021	.274
1915	1	7	.053	.051	.080	.077	.006	.255	.022	.277
	2	20	.088	.031	.079	.053	.002	.249	.016	.265
	3	35	.141	.042	.116	.089	.001	.387	.044	.431
	4	45	.250	.111	.236	.315	(2)	.912	.069	.981
	Total	107	.071	.048	.086	.079	.005	.279	.023	.302
1916	1	9	.068	.059	.077	.080	.008	.276	.024	.300
	2	19	.116	.038	.090	.064	.002	.306	.022	.328
	3	43	.194	.050	.122	.107	.002	.480	.051	.531
	4	45	.275	.072	.224	.311	(2)	.882	.078	.960
	Total	116	.088	.056	.085	.084	.007	.306	.027	.333
1917	1	10	.090	.067	.091	.074	.013	.309	.031	.340
	2	19	.148	.044	.089	.060	.002	.339	.041	.380
	3	49	.239	.067	.140	.126	.001	.571	.051	.622
	4	53	.345	.101	.244	.305	.001	.994	.097	1.091
	Total	131	.113	.064	.097	.080	.010	.344	.035	.379
1918	1	10	.105	.064	.097	.072	.015	.343	.038	.381
	2	22	.183	.065	.105	.062	.002	.413	.056	.469
	3	47	.289	.091	.142	.108	.001	.629	.061	.690
	4	55	.431	.119	.251	.295	.003	1.093	.098	1.191
	Total	134	.134	.082	.104	.076	.012	.384	.044	.428
1919[3]	1	11	.131	.098	.101	.070	.015	.385	.040	.425
	2	22	.215	.068	.115	.059	.003	.454	.045	.499
	3	39	.325	.100	.138	.119	.001	.681	.068	.749
	4	47	.414	.136	.262	.307	.001	1.118	.094	1.212
	Total	119	.156	.095	.106	.075	.013	.419	.044	.463

[1] Deduction. [2] Less than one-tenth of 1 cent. [3] First 6 months.

The above table shows that group 1, which includes the companies having the largest annual production, had much lower costs of production than any other group, except in 1915, when group 2 was slightly lower; and that the costs for the other three groups increased very materially as the quantity of production decreased. The difference in cost between companies producing 1,000,000 barrels or over per year and those producing from 250,000 to 1,000,000 barrels is not great, particularly in the earlier years; but there is a large difference between the costs of groups 2 and 3, and a still larger difference between those for groups 3 and 4.

The lifting cost is materially lower for group 1 for each year than for any other group, and this item of cost increases very rapidly as the quantity of the annual production for the groups decreases. Group 4 shows the highest costs for each main item of expense throughout the entire period, and group 3 has the second highest cost for each item throughout the period, except for general and administrative

expense for the first three years, when it is lower for this item than group 1. Group 1 shows a comparatively high general and administrative expense throughout the period. Group 2 shows the lowest cost of depletion throughout the period and group 1 the second lowest.

As many of the companies do not have any income from natural gas and a large number operate only on their own oil lands, the credits and royalty items for different groups are not comparable.

The volume of production per well is one of the most important factors in the cost of producing crude petroleum. As a rule, the lower average costs shown for producers having the largest production was chiefly due to their large average production per well. A large volume of production per well is largely the result of good fortune in securing choice oil lands and can be influenced but slightly by the operating companies. In California the larger companies control, either through ownership or lease, the bulk of the best oil lands thus far developed, and their large capital enables them to take advantage of discoveries in new fields by buying choice acreage. The large companies are also doubtless able to make certain economies in their operations that are not practicable for small companies. However, the fact should not be overlooked, that mere good fortune in drilling a big gushing well may give any producer a decided advantage over the largest or the most efficient companies. Sometimes companies have become large because they were fortunate in having highly productive wells with a low cost of production; in other words, large size may sometimes be the result of low cost of production and not the reason for low cost of production.

The effect of the volume of production per well on the cost of production in 1914 is shown in the following table:

TABLE 46.—*Effect of volume of production per well on the cost of production, in barrels of 42 gallons, in California, in 1914.*

Range of production per well per annum in barrels.	Number of companies.	Cost per barrel.					
		Lifting expense.	General and administrative.	Depreciation.	Depletion.	Credits.	Total
Over 100,000	3	$0.017	$0.005	$0.006	$0.006	.....	$0.034
25,000–100,000	7	.033	.057	.061	.077	$0.010	.223
10,000–25,000	35	.086	.038	.070	.048	.001	.241
5,000–10,000	25	.145	.045	.090	.108	.002	.386
Under 5,000	21	.143	.050	.169	.106	.001	.472

The lifting expense and depreciation show a rapid increase as the quantity produced per well per year is decreased. The general and administrative expense and depletion are very low for the largest production but do not increase uniformly as the production per well decreases. The total cost shows a steady increase as the volume produced per well decreases.

The quantity of the crude petroleum produced affects very materially every element of cost. However, its full influence on cost can not be shown on account of the effect of various other factors such as the investment in wells and equipment, the investment in producing property and the quality of the crude petroleum pro-

duced. Depreciation, which is quite an important item, depends upon the cost of the wells and equipment. The cost of the wells varies greatly according to the depth, the character of the formation, and the water and other difficulties encountered in drilling. The depletion charge, which is another important element of cost, depends upon the amount of the investment in oil lands. Some companies have been fortunate in securing their oil lands for a small investment, while others, owning no more productive property, have investments many times larger. Hence, so far as an individual company is concerned its cost per barrel may be relatively low, while its production per well is small because its depreciation and depletion are very low, while the costs of another company having a large production per well are burdened with very high costs for these items. Differences in the quality of the crude petroleum produced in different fields and on different properties in the same field affects the lifting cost. The light grades of crude petroleum are much more easily brought to the surface than the heavy low grade crudes, some of which are very viscous.

INCREASE IN COST.—The rapid increase in the cost of producing crude petroleum in California during the period 1914–June 30, 1919, is shown in the following table, which shows the increase in the principal items of cost, by index numbers, based on 1914 as 100:

TABLE 47.—*Index numbers showing changes in items of cost of production, as computed by the Commission, 1914–June 30, 1919.*

Year	Lifting.	General and administrative.	Depreciation.	Depletion.	Royalty.	Total
1914	100	100	100	100	100	100
1915	104	108	118	111	108	110
1916	129	127	116	118	127	122
1917	166	145	133	112	166	138
1918	197	185	142	108	208	156
1919[1]	229	214	146	105	205	169

[1] First 6 months.

So far as the general movement of costs is concerned, the index numbers show, with the exception of depletion, that the general trend was upward throughout the period. The increase from year to year is more pronounced beginning with 1916. The greatest changes are shown for lifting, which increased 129 per cent, and general and administrative expense the increase for which was 114 per cent. Throughout the period the lifting cost constituted from one-fourth to one-third of the total cost of producing crude petroleum. All operating labor items are included in lifting expense and the maximum increase shown for this part reflects largely the advance in wages of field employees. Depreciation increased 46 per cent and depletion, after reaching its maximum in 1916, declined steadily until it was only 5 per cent higher for the first six months of 1919 as compared with 1914. The total average cost shows a steady increase, being 69 per cent higher for the first half of 1919 as compared with the year 1914. Another important factor which was responsible for this increase was the decline in the average production per well. (See p. 131.)

COST OF PRODUCTION BY COMPANIES.—There is a very wide range in the costs as computed by the Commission for the different producing companies. The lowest costs for an individual company and the lowest range of costs for all companies are shown for 1914 and the highest for a full year's operations in 1918. In 1914 the lowest company cost was $0.031 per barrel and the highest $1.96, while in 1918 the lowest was $0.14 per barrel and the highest $5.36. The costs for 96 companies in 1914 arranged from the lowest to the highest cost are given in Appendix Table 39, while the following table shows such costs for 133 companies in 1918:

TABLE 48.—*Lifting cost and total cost of producing crude petroleum per barrel, by companies, arranged from the lowest to the highest total cost for 1918.*

[The costs for one company have been omitted from this table for 1918 because the figures are of doubtful accuracy and would be misleading.]

Company.	Lifting cost.	Total cost.	Per cent of production covered.	Company.	Lifting cost.	Total cost.	Per cent of production covered.	Company.	Lifting cost.	Total cost.	Per cent of production covered.
1	$0.032	$0.140	.....	46	$0.233	$0.601	.....	91	$0.224	$0.985	.....
2	.113	.225	.....	47	.208	.606	.....	92	.213	.985	.....
3	.140	.244	.....	48	.232	.608	.....	93	.676	.991	97.0
4	.122	.245	.....	49	.341	.611	.....	94	.297	1.006	.....
5	.061	.250	.....	50	.386	.635	.....	95	.460	1.006	.....
6	.083	.261	.....	51	.118	.635	.....	96	.325	1.017	.....
7	.200	.281	.....	52	.297	.641	.....	97	.585	1.022	.....
8	.133	.291	.....	53	.177	.651	.....	98	.378	1.024	.....
9	.066	.296	.....	54	.260	.660	.....	99	.229	1.025	.....
10	.067	.305	42.1	55	.267	.674	.....	100	.207	1.084	.....
11	.229	.320	.....	56	.192	.677	.....	101	.390	1.097	.....
12	.090	.328	.....	57	.324	.682	.....	102	.657	1.108	.....
13	.082	.331	.....	58	.266	.700	.....	103	.171	1.116	.....
14	.101	.351	.....	59	.397	.713	.....	104	.337	1.133	.....
15	.182	.357	53.0	60	.471	.715	.....	105	.319	1.137	.....
16	.130	.367	.....	61	.349	.723	.....	106	.330	1.139	.....
17	.161	.388	.....	62	.450	.724	.....	107	.431	1.143	.....
18	.326	.412	.....	63	.288	.734	.....	108	.619	1.175	.....
19	.263	.419	.....	64	.385	.741	.....	109	.683	1.210	.....
20	.235	.420	54.9	65	.230	.744	.....	110	.593	1.269	.....
21	.122	.422	.....	66	.422	.747	.....	111	.496	1.270	.....
22	.271	.422	.....	67	.202	.751	.....	112	.600	1.304	.....
23	.129	.449	.....	68	.406	.764	.....	113	.607	1.307	.....
24	.222	.450	.....	69	.540	.769	.....	114	.499	1.316	.....
25	.181	.454	.....	70	.332	.781	.....	115	.555	1.323	.....
26	.232	.459	.....	71	.336	.784	.....	116	.289	1.335	.....
27	.279	.461	.....	72	.495	.793	.....	117	.292	1.359	.....
28	.169	.468	.....	73	.378	.799	.....	118	.399	1.368	.....
29	.181	.470	.....	74	.290	.799	.....	119	.879	1.443	.....
30	.143	.485	73.8	75	.361	.800	94.9	120	.349	1.448	.....
31	.205	.486	.....	76	.191	.801	.....	121	.497	1.508	.....
32	.221	.489	.....	77	.405	.808	.....	122	.875	1.535	.....
33	.167	.489	.....	78	.261	.812	.....	123	.338	1.708	.....
34	.161	.497	.....	79	.533	.813	.....	124	.792	1.843	.....
35	.332	.501	.....	80	.198	.839	.....	125	1.035	1.889	.....
36	.339	.509	.....	81	.277	.840	.....	126	.858	2.181	.....
37	.166	.532	.....	82	.412	.868	.....	127	.394	2.252	.....
38	.138	.560	.....	83	.360	.895	.....	128	.941	2.253	.....
39	.205	.561	.....	84	.670	.905	.....	129	1.204	2.781	.....
40	.152	.568	89.1	85	.467	.910	.....	130	.722	2.867	.....
41	.163	.569	.....	86	.275	.929	.....	131	.424	4.196	.....
42	.242	.583	.....	87	.453	.935	.....	132	.678	4.666	.....
43	.068	.584	.....	88	.548	.950	.....	133	.621	5.364	.....
44	.285	.589	.....	89	.634	.953	.....				
45	.127	.595	.....	90	.641	.954	.....				

The costs for individual companies cover 96 companies in 1914 and 133 in 1918. The costs for one company, which were included in the group totals, have been omitted from this tabulation because they are of doubtful accuracy and would be misleading. The inclusion of this company's costs in the totals for all companies and

in the group totals does not affect the averages appreciably, as its production is a very small proportion of the total.

The two lowest costs in 1914, namely, 3.1 cents per barrel and 3.8 cents per barrel, were exceptional and were the result of a very large initial production per well from flowing wells. The lifting costs were only 1.8 cents per barrel for the company showing the lowest cost and 1 cent per barrel for the other company. In 1918, on the other hand, a number of companies show very high costs, ranging as high as $5.36 per barrel for one company. Such high costs are not significant, as they represent very unfavorable operating conditions. In 1914, 7 companies show costs in excess of $1 per barrel, while in 1918 there were 40 companies, or about one-third of the total companies for which costs are shown, that show costs in excess of $1 per barrel. The 7 companies in 1914 which show costs in excess of $1 per barrel produced only 183,320 barrels, or an average of 26,190 barrels per company, for the entire year. The 41 companies having costs in excess of $1 per barrel in 1918 produced 2,450,059 barrels, or an average of 59,758 barrels per company, for that year. While these 41 companies represent almost 31 per cent of the total number, they produced only 3 per cent of the total production. As shown in Table 45, the average cost for all companies in 1918 was 42.8 cents per barrel, while as shown above 89.1 per cent of the total was produced by 40 companies at a cost not exceeding 56.8 cents per barrel. In 1914, 13 companies produced 50.8 per cent of the total included in Appendix Table 39 at costs ranging from 3.1 cents to 24.8 cents per barrel; almost 80.5 per cent of the total was produced at a cost not exceeding 38.6 cents per barrel; 95.6 per cent was produced at a cost not exceeding 48.3 cents per barrel; and the cost of producing 98 per cent was 70 cents per barrel or less, while the cost of the remaining 2 per cent ranged from 70.1 cents to $1.961 per barrel.

The 1918 costs average much higher than those for 1914, and the range between the lowest and highest cost was much greater. Ten companies produced 42.1 per cent of the total quantity of crude petroleum covered in the above table at costs ranging from 14 cents to 30.5 cents per barrel. Fifteen companies produced 53 per cent of the total at costs not exceeding 35.7 cents per barrel; 69.6 per cent was produced at not exceeding 45.9 cents per barrel; 89.1 per cent at a cost of 56.8 cents or less per barrel; and 99 per cent at a cost not exceeding $1.116 per barrel; while the costs for the remaining 1 per cent ranged from $1.133 to $5.364 per barrel.

There is a very wide range in the lifting cost. The lowest for the entire period was 1 cent per barrel for the companies showing the second lowest costs in 1914, while in 1918 the lowest lifting cost was 3.2 cents per barrel. The highest lifting cost in 1914 was 72.1 cents per barrel and in 1918 it was $1.204 per barrel. As a rule, the companies showing the lowest costs have lower lifting costs than those having high total costs; for example, in 1914 the lifting cost for companies producing crude petroleum at less than 25 cents per barrel ranged from 1 cent to 10.2 cents, those showing costs from 25 to 50 cents per barrel show lifting costs of from 3.7 cents to 29 cents per barrel, and companies whose total costs range from 50 to 75 cents per barrel had lifting costs varying from 7.4 cents to 31 cents per barrel.

The wide range in the cost of producing crude petroleum, varying importance of the item of lifting cost, and the relative posi of the companies, according to the size of their annual production graphically presented in Chart I, opposite, which shows the 1918 c for 133 companies arranged in order from the lowest to the hig total cost.

COST OF PRODUCTION BY FIELDS.—There is a considerable differe in the quality of the crude petroleum produced in the different fi in the average depth of the wells, in the cost of drilling them, in number of acres per well, in the productivity of the wells and lea and in the original cost of the property. All of these factors have effect upon the cost of producing crude petroleum. The quality the crude affects the lifting cost, the cost of wells, the amount depreciation, and the cost of the properties the amount of depleti while the volume of production affects all items and is the m important factor in crude petroleum production. As shown in pendix Table 4, the Summerland field had the smallest acreage well in 1918, only 1.6 acres, and it produced 237 barrels per a while the Santa Maria field had 23.3 acres per well and produced barrels per acre. The largest number of barrels per acre was secu in the Whittier-Fullerton field, which produced 4,754 barrels per a in 1918.

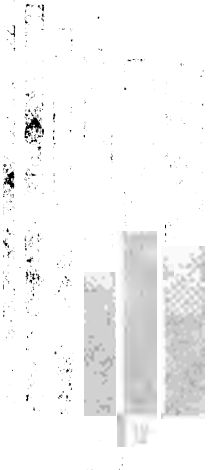
The cost of producing crude petroleum for companies operatin more than one field was lower than that for producers in any of fields excepting the McKittrick field, and it was lower than that f for three of the five and one-half years. This comparative lowness cost is due to the fact that the large producers own and operate m of the best oil lands in the different fields in the State. The rang the costs by fields throughout the period was very wide; for exam the lowest cost for a particular field was 28.2 cents in 1914 and highest 48.7 cents, while in 1918 it varied from 38 cents to 7 cents. In other words, in 1914 the highest cost by fields was 72 cent greater than the lowest, while in 1918 it was 99 per c greater. The following table shows the cost of producing cr petroleum by fields for the period 1914–June 30, 1919:

TABLE 49.—*Cost of production per barrel, by fields, 1914–June 30, 1919.*

Fields.	1914	1915	1916	1917	1918	1
McKittrick	$0.282	$0.307	$0.255	$0.286	$0.380	
Nonseparable[2]	.238	.246	.265	.317	.365	
Whittier-Fullerton	.315	.324	.380	.445	.438	
Coalinga	.422	.457	.410	.409	.441	
Ventura-Newhall	.487	.505	.606	.711	.643	
Kern River	.430	.452	.515	.648	.756	
Midway-Sunset	.299	.441	.524	.577	.652	
Los Angeles and Salt Lake	.366	.433	.495	.646	.742	
Santa Maria	.425	.369	.625	.694	.708	
All fields	.274	.302	.333	.379	.428	

[1] First 6 months.
[2] Includes cost for companies operating in more than 1 field.

There was a considerable increase in the cost of production for e field from 1914 to June 30, 1919. The smallest increase is sh for the Coalinga field, which only increased from 42.2 cents to cents, while the largest increase was from 42.5 cents to 93.2 cent



the Santa Maria field. The small increase in the Coalinga field was the result of an increase in the average annual production per well from 15,470 barrels in 1914 to 17,184 barrels in 1918. In this field the cost increased whenever the average annual production per well declined and it decreased when the average production per well increased. In the Midway-Sunset field the average production per well declined steadily from 34,499 barrels in 1914 to 15,381 barrels in 1918, while the costs increased steadily from year to year. Every oil field for which costs are presented shows an increase in cost for every year when the average production per well decreased, while in every case except the Santa Maria field an increase in the average production per well resulted in a lower cost per barrel. This relation between the quantity produced per well and cost fluctuations is clearly shown in the following table:

TABLE 50.—*Relation of per barrel cost of production and the average annual production per well for representative fields, 1914–1918.*

Year.	Coalinga field.		McKittrick field.		Midway-Sunset field.		All fields.	
	Average production per well.	Cost per barrel.	Average production per well.	Cost per barrel.	Average production per well.	Cost per barrel.	Average production per well.	Cost per barrel.
1914	15,500	$0.422	15,300	$0.282	34,500	$0.299	21,900	$0.274
1915	12,000	.457	13,000	.307	21,800	.441	18,800	.302
1916	18,100	.410	16,950	.255	18,500	.524	18,800	.333
1917	18,800	.409	16,100	.286	16,800	.577	17,400	.379
1918	17,200	.441	11,400	.380	15,400	.652	14,300	.428

The relation between the cost per barrel and the average production per well shown in the above table indicates that the increase in cost for the period was partly the result of the decline in the average production per well.

Detailed information concerning each field is shown in Appendix Table 40, while in the following table the more important items are shown for 1918:

TABLE 51.—*Important factors in the cost of production of crude petroleum, by fields, 1918.*

Field.	Production.			Cost.	
	Total.	Per company.	Average per well.	Lifting.	Total.
Nonseparable[1]	54,674,883	2,733,744	15,680	$0.108	$0.365
McKittrick	908,937	129,848	11,362	.197	.380
Whittier-Fullerton	2,324,668	258,297	9,956	.151	.438
Coalinga	9,520,211	366,162	17,184	.148	.441
Ventura-Newhall	917,380	101,931	8,154	.180	.643
Midway-Sunset	9,267,093	243,871	15,381	.206	.652
Santa Maria	1,525,729	217,961	17,240	.233	.708
Los Angeles-Salt Lake	563,251	140,813	4,251	.257	.742
Kern River	982,963	70,212	2,862	.381	.756
Total	80,685,115	602,128	14,321	.134	.428

[1] Includes cost for companies operating in more than one field.

As a rule, the investment in oil wells increases with the depth; hence, this factor is of importance with reference to the cost of depreciation. The depth of the well and the quality of the crude—i. e., heavy or light crude—have an effect upon the lifting cost. The quantity produced per well each year is undoubtedly the most important factor in unit costs. The items of general and administrative expense are not affected by the quality of the crude nor by the depth of the wells.[1]

The lowest cost per barrel is shown for companies operating in a number of fields. Most of the companies having a large annual production operated in a number of fields and they owned a very large part of the best producing oil lands. The average production per company for companies operating in various fields was 2,733,744 barrels in 1918. This average is almost eight times as large as that for the Coalinga field, which shows the second largest average per company. These companies had a large average production per well and show the lowest lifting cost.

The lowest cost for a particular field is shown for the McKittrick field for the entire period. Its cost was 38 cents per barrel, which is 1.5 cents higher than that for the large companies operating in a number of fields. The average annual production for the seven companies in this field was only 129,848 barrels, and the average annual production per well 11,362 barrels. The crude petroleum produced in this field is heavy and the wells are quite deep. The companies in this field show rather high lifting costs but very low general and administrative and depreciation costs. The lifting cost for this field was considerably above the average. This is probably accounted for by the character of the crude, the depth of the wells, and the fact that the average production per well was considerably less than the average for all fields. The general and administrative and depreciation costs were much below the average.

The Whittier-Fullerton field shows the second lowest cost for a particular field. The average production per company of 258,297 barrels was the second largest for a particular field. The average annual production per well was 9,956 barrels as compared with 14,321 for all fields. There is a very wide range in the depth of the wells in this field. The crude petroleum produced in the Whittier-Fullerton field is largely a high grade light refinable crude. The lifting cost was the second lowest for a particular field, the general and administrative cost was lower than the average, depreciation was about the same as the average, while the depletion was lower than for any other field.

The Coalinga field ranks third in lowness of cost for a particular field. The companies included in the costs for this field show the second highest average annual production per well and the highest average production per company. The crude petroleum produced in the Coalinga field is mostly light crude petroleum. There is a wide range in the depths of the wells, some being very shallow and others very deep. This field shows the lowest lifting and general and administrative costs, while the depreciation and depletion costs were comparatively high. The high average production per well and the quality of the crude probably explain the low lifting cost.

The Midway-Sunset field ranked fifth in lowness of cost, but there was a very wide margin between its cost and that shown for the first

[1] See Ch. III for a description of the different fields.

three fields. Depreciation was the only item of cost that is comparatively low. The crude petroleum produced in this field is considerably heavier than that produced in the first two fields. The wells show a wide range in depth, but the annual average production per well is quite high.

The Los Angeles-Salt Lake, Ventura-Newhall, Kern River, and Santa Maria fields follow in the order named. The crude petroleum produced in the Ventura-Newhall field is high grade light crude petroleum, while that produced in the other fields is comparatively heavy. The Ventura-Newhall wells are comparatively shallow, the Los Angeles-Salt Lake wells are about the average, while the Santa Maria wells are quite deep. The Los Angeles-Salt Lake fields show a small annual average production per well, the Ventura-Newhall average was much below that for all fields, while the Santa Maria average was higher than that for any other field. The effect of the large average production in this latter field was offset by the character of the crude and the high depreciation charge.

The Kern River field shows next to the highest cost for any of the fields for which costs are shown. The crude petroleum produced in this field is very heavy, the wells are shallow, and the average annual production per well much smaller than for any other field. The cost of depreciation was relatively lower than any other item. This was probably the result of the shallow wells, but the average annual production per well was so low that the influence of this factor was obscured.

Section 4. Comparison of costs and prices.

As already shown, there are wide variations in the cost of producing crude petroleum by groups and much wider variations in the costs for individual companies. The prices of crude petroleum have no definite relation to the cost of production, but depend rather upon the supply and demand for petroleum products. In the long run, however, unless producers secure a price for their crude petroleum that enables them to operate at a profit there will be less incentive to drill new wells. Some wells that are already producing will continue to be operated, even though this involves a temporary loss, because there is danger of their being ruined if closed down, while the most unprofitable wells may be abandoned.

As shown elsewhere, the cost of drilling as well as the cost of production increased considerably in the last five or six years, and notwithstanding the price of crude oil has advanced in the meantime, comparatively few wells were drilled by the small companies. Probably the chief reason for the failure of those companies to engage extensively in drilling operations is to be found in the relation between the cost of production and the prices for crude petroleum. A comparison between the cost of production by groups and the prices of certain grades of crude petroleum at the producers' tanks in the oil fields is shown in Table 52.

TABLE 52.—*Cost of production, as computed by the Commission, and average annual prices of representative grades of crude petroleum, 1914–June 30, 1919.*

Year.	Cost of production per barrel.					Price per barrel.		
	Group 1.	Group 2.	Group 3.	Group 4.	All groups.	Under 18° Baumé.	24° Baumé.	27° Baumé.
1914	$0.25	$0.29	$0.49	$0.72	$0.27	$0.39	$0.43	$0.53
1915	.28	.27	.43	.98	.30	.36	.41	.46
1916	.30	.33	.53	.96	.33	.60	.67	.72
1917	.34	.38	.62	1.09	.38	.87	.94	1.00
1918	.38	.47	.69	1.19	.43	1.15	1.22	1.28
1919[1]	.43	.50	.75	1.21	.46	1.23	1.33	1.39

[1] First 6 months.

The prices for the three grades of crude oil are averages based upon the announced prices of the Standard Oil Co. (California). According to this company, during the period under discussion, from 31 per cent to 35 per cent of all crude petroleum produced in California ranged below 18° Baumé. The balance of the crude product is classed as light crude and for average price purposes the 24° gravity grade is said to be fairly representative of the light grades. The proportion of crude ranging from 24° gravity to 27° gravity has increased in the last few years, and while there was only 4 to 6 cents per barrel difference in the price above the 24° gravity grade its inclusion in the table affords a slightly wider and more satisfactory basis of comparison.

Both average annual prices and the cost of producing crude petroleum increased steadily from 1914 to June 30, 1919, excepting in 1915. By comparison of the prices with the costs for the different groups it is seen that the average cost for groups 1 and 2, which include companies producing more than 250,000 barrels per year, were materially lower than the average price of the lowest priced crude petroleum. The average cost for the companies in group 3, which produced from 50,000 to 250,000 barrels per year, was higher than the average price of the crude petroleum under 18° Baumé and also the 24° Baumé grade in 1914 and 1915, while from 1916 to June 30, 1919, the prices exceeded the costs and the margin between the cost and the average prices for all grades increased steadily. The average costs for companies in group 4 greatly exceeded the average prices for all grades from 1914 through 1917; in 1918 the average cost was slightly higher than the average price of the crude under 18° Baumé, but in 1919 the prices for all grades were higher than the average costs.

As shown in Table 48, the costs of a number of individual companies were greatly in excess of the price of the highest grade of crude petroleum shown. Even when prices are very remunerative for most producers, there are certain companies in the crude petroleum-producing business that do not secure a sufficient quantity to make their operations profitable. The business of producing crude petroleum is a speculative one and under normal conditions the highest cost producers may have costs greatly in excess of the price received for their products, while other companies, either during their early operations or when the oil deposits on their properties have been almost exhausted, may also show losses on their operations.

The influence of the low cost companies in groups 1 and 2, which produce a very large proportion of the total production, is so great that quite profitable results are indicated if the comparison be restricted to the average for all groups combined. In the foregoing discussion, however, it has been shown that the groups of producers having a small annual production had high costs, and that they show a loss for a large part of the period. In all the groups it will be noted that, except in 1915, when prices declined, the upward movement in costs was accompanied by a still stronger advance in prices. This had a decided effect in increasing the margins between costs and the average price of the different grades, while the position of the high cost companies was greatly improved.

In 1920 the base price for crude petroleum under 18° Baumé advanced to $1.60 per barrel, the average for the year being $1.49 per barrel. The 24° Baumé grade rose to $1.88, with an average of $1.75 per barrel, while the 27° Baumé grade advanced to $2.15 per barrel, with an average for the year of $2.01 per barrel. Even with somewhat increased costs of production in 1920, the business of producing crude petroleum in California should have been much more profitable than for any other year since 1914.

Section 5. Comparison of Commission and company costs.

The costs of producing crude petroleum presented in the previous sections have been those computed by the Commission. As the result of revisions made by the Commission, these costs differ somewhat from those shown by the records and reports of the various companies. The differences between the company costs and those computed by the Commission are due to the Commission's adjustments of depreciation and depletion, to the elimination from costs of charges for nonproductive and incidental drilling, and of certain other miscellaneous charges which were either capitalized or charged directly to profit and loss or to surplus. The following table shows the Commission's costs, the company's costs, the difference between the two and the items accounting for this difference:

TABLE 53.—*Cost of producing crude petroleum, as computed by the Commission and as reported by the companies, per barrel, by groups, 1914–June 30, 1919.*

Item.	Average per barrel.					
	1914	1915	1916	1917	1918	1919 [1]
Group 1:						
Commission cost	$0.245	$0.277	$0.300	$0.340	$0.381	$0.425
Company cost	.274	.305	.385	.485	.582	.594
Difference	.029	.028	.085	.145	.201	.169
Group 2:						
Commission cost	.286	.265	.328	.380	.469	.499
Company cost	.288	.255	.351	.504	.729	.698
Difference	.002	.010	.023	.124	.260	.199
Group 3:						
Commission cost	.493	.431	.531	.622	.690	.749
Company cost	.427	.396	.499	.617	.843	.776
Difference	.066	.035	.032	.005	.153	.027

[1] First six months.

TABLE 53.—*Cost of producing crude petroleum, as computed by the Commission and as reported by the companies, per barrel, by groups, 1914–June 30, 1919*—Continued.

Item.	Average per barrel.					
	1914	1915	1916	1917	1918	1919
Group 4:						
Commission cost	$0.721	$0.981	$0.960	$1.091	$1.191	$1.212
Company cost	.489	.788	.709	.855	1.124	.945
Difference	.232	.193	.251	.236	.067	.267
All groups:						
Commission cost	.274	.302	.333	.379	.428	.463
Company cost	.289	.313	.394	.503	.629	.622
Difference	.015	.011	.061	.124	.201	.159
Commission's adjustments:						
Depreciation	.019	.022	.028	.058	.066	.050
Depletion	[1].031	[1].032	[1].005	.017	.025	.034
Nonproductive drilling	.008	.010	.008	.017	.030	.005
Incidental drilling					.019	.032
Other	.019	.011	.030	.032	.061	.037
Total	.015	.011	.061	.124	.201	.159

[1] Deduction.

There are two significant facts disclosed by this table, first, that throughout the period, except in 1915, the costs reported by producers in groups 1 and 2, whose annual production was 250,000 barrels of crude petroleum, were higher than those computed by the Commission, the excess in the last three years being especially large; second, that in the case of the smaller companies in groups 3 and 4 the situation is radically different. Excepting in 1918 and 1919, the Commission costs are higher for group 3, while in the case of companies in group 4, that produced less than 50,000 barrels per year, the Commission's costs in each year of the period are greatly in excess of the reported costs.

As already stated, the difference in costs is largely due to the Commission's adjustment of depreciation and depletion and to drilling charges. In the case of producers in groups 1 and 2, especially, large amounts charged to depreciation and depletion have been disallowed as being in excess of a normal charge. On the other hand, among the smaller producers, particularly those in group 4, charges for depreciation and depletion were in some cases entirely omitted by the companies. In a lesser degree also the same was true of producers in group 3 during the first four years of the period. In the costs computed by the Commission depreciation and depletion were charged uniformly at the rates already explained, and as a consequence the Commission's costs for the smaller companies were materially greater than the reported costs.

Other differences in costs were due to the practice of some companies of charging to the cost of producing oil items properly chargeable either to the investment or profit and loss accounts or belonging to some other branch of the business. Expenditures of this character were omitted from costs as not being properly chargeable to the cost of producing crude oil.

In the data for all groups combined, the details for the principal cost items are given, together with the unit cost for the important

items constituting the difference between the Commission's costs and reported costs. In this connection it will be noted that the largest single item of difference was for depreciation, the excess in reported costs for which was from 2 to more than 6 cents per barrel. It will be noted also that in the first three years of the period the reported cost for depletion was less than that of the Commission. As already indicated, the marked increase in the amounts disallowed for depreciation and depletion in the last three years of the period is due to the abnormally high charges made by some companies.

Section 6. Cost of drilling oil wells.

There was a marked increase in the cost of drilling oil wells in California from 1914–1919. The Commission obtained reports from companies covering from 34 per cent of all the oil wells drilled in 1914 to 67 per cent in 1919. The increase in the cost per well from 1914–1919 was 97 per cent; however, this was partly due to the greater average depth, which increased from 2,047 feet to 2,231 feet. The following table shows the number of wells reported, their average depth, the average cost per foot and per well, and the percentage of increase from 1914–1919:

TABLE 54.—*Average cost of drilling oil wells, as reported to the Commission, 1914–1919.*

Year.	Drilled.	Average depth.	Cost per foot.	Cost per well.	Increase in cost per well.
	Number.	*Feet.*			*Per cent.*
1914	175	2,047	$10.54	$21,575	.....
1915	124	2,695	10.70	28,836	34
1916	389	1,941	9.83	19,080	[1]12
1917	465	2,066	12.22	25,246	17
1918	389	2,194	15.95	34,994	62
1919	364	2,231	19.05	42,500	97

[1] Decrease.

As shown above, the cost of drilling wells in the California oil fields has increased during recent years. In 1914 reports to the Commission for 175 wells drilled in the different oil fields of California show that the cost of drilling a well ranged from $11,079 to $31,121, the average being $21,575. The depth of these wells ranged from 1,406 feet to 2,985 feet, the average being 2,047 feet. In 1919 the costs of drilling oil wells in California varied from $14,453 for wells averaging 1,030 feet deep to $77,116 for wells that averaged 2,724 feet in depth, while the average cost of 364 wells for which reports were received, which averaged 2,231 feet in depth, amounted to $42,500. This average appears typical for the entire State, for, according to R. P. McLaughlin, State oil and gas supervisor of California, "the amount of money involved in drilling a well varies from $15,000 to $100,000, with the average probably about $40,000.[4]" Such costs prevent the smaller producers and companies with small financial resources from engaging extensively in drilling operations. Furthermore, some small producers have had such high costs of production for several years past (see p. 146) that they have lost money;

[4] Bulletin American Association of Petroleum Geologists, vol. 4, Nov. 1, 1920.

hence it is not surprising that they have not increased their drilling operations.

The cost of drilling oil wells increases rapidly with the increase in depth; for example, in 1918 wells averaging 2,950 feet deep cost on the average $35,390, while others drilled in the same field with an average depth of 3,390 feet show an average cost of $60,460. The following table shows a comparison of the cost of drilling shallow wells in the Kern River field with that for deep wells in the Whittier-Fullerton field:

TABLE 55.—*Cost of drilling shallow wells in the Kern River field and deep wells in the Whittier-Fullerton field.*

Company.	Kern River field (1917).			Whittier-Fullerton field (1918).		
	Depth per well.	Cost per well.	Cost per foot.	Depth per well.	Cost per well.	Cost per foot.
	Feet.			*Feet.*		
No. 1	1,195	$17,698	$14.81	3,391	$60,462	$17.83
No. 2	950	4,864	5.12	3,039	41,725	13.73
No. 3	850	6,800	8.00	3,152	49,517	15.71
No. 4	625	4,114	6.58	2,954	35,389	11.98

As shown above, the cost of drilling oil wells varies with the depth, but numerous difficulties which are often encountered in the drilling operations or differences in the character of the formations may cause a comparatively shallow well to cost more than one very much deeper. In fields where the characteristics of the strata formation through which the drill must pass have come to be known by previous drilling work the cost of new wells can be approximated within reasonable limits. Where water troubles are numerous, and also when mechanical difficulties occur in drilling, there is a wide range in costs of different wells of the same depth.

A considerable part of the cost of drilling and in the maintenance of oil wells is represented by the expenditures for casing, tubing, rigs, and other materials. In order to determine the importance of this particular factor, prices were obtained for the principal articles used in oil-field operations from several of the largest companies. Averages of the prices furnished by the companies are shown in Appendix Table 41.

For most of the materials and supplies the highest prices prevailed in 1918. Prices on two sizes of bailers and 25-horsepower gas engines reached their highest level in 1919, while a number of other articles, including bit steel, rig iron, drilling-stem pins, rig timber, steam engines, and band-wheel powers, continued to advance up to January 1, 1920. Casing comprises a large part of the expense in drilling wells. Prices on the different sizes reached their maximum in 1918, following which there was a decline of about 7 to 9.5 per cent. Taking the list of articles as a whole, prices generally were from 90 to more than 100 per cent higher in 1918 and 1919 than those in effect July 1, 1914.

Section 7. Producing investment.

TOTAL NET INVESTMENT.—The net investment is shown for all companies for which satisfactory information regarding the cost of

producing crude petroleum was secured. In the case of the five large companies, as well as some of the smaller companies, this information was secured directly from their records or was checked with the companies' books by examiners of the Commission; but for the greater number of the smaller companies the investment data were compiled from the balance sheets and supporting statements prepared by the companies and submitted to the Commission, and were not checked with their records.

The information for producing investment as submitted by the companies has been revised to some extent by the Commission. This revision resulted chiefly from the elimination of all appreciation values, the adjustment of charges for depreciation and depletion (see p. 119), the capitalization of items where erroneously charged to costs, the elimination of deferred charges where claimed as investment, and adding back of accrued liabilities, such as accrued income tax, when deducted by the companies from working capital. The following table shows the total investment as shown by the companies' reports, the companies' net investment in producing property, the Commission's revisions, and the Commission's revised net investment in the petroleum-producing business:

TABLE 56.—*Net investment in producing business, as shown by the companies' records and as revised by the Commission, 1914–June 30, 1919.*

Item	1914	1915	1916	1917	1918	1919 [1]
Companies' total investment	$326,833,638	$330,360,862	$386,081,735	$487,241,974	$522,792,402	$521,347,904
Less outside investment	135,400,279	137,918,968	167,511,763	190,919,763	223,834,590	228,333,323
Companies' investment in production	191,433,359	192,441,894	218,569,972	296,322,211	298,957,812	293,014,581
Less Commission's adjustments:						
Appreciation	[2] 40,799,407	[2] 40,948,916	[2] 42,539,332	[2] 86,871,625	[2] 87,812,431	[2] 87,133,587
Depreciation	1,219,151	2,405,738	4,123,010	8,592,922	13,467,228	15,484,590
Depletion	[2] 1,584,038	[2] 2,944,055	[2] 4,066,606	[2] 113,668	6,982,284	11,560,684
Miscellaneous adjustments	[2] 397,189	[2] 955,901	[2] 933,969	1,017,713	3,507,127	7,445,043
Total	[2] 41,561,483	[2] 42,443,134	[2] 43,416,897	[2] 77,374,658	[2] 63,855,792	[2] 52,643,270
Investment in production as revised by the Commission	149,871,876	149,998,760	175,153,075	218,947,553	235,102,020	240,371,311

[1] June 30. [2] Deduction.

The entire net investment of the companies for which costs of producing crude petroleum are shown includes their net investment as shown by their records and checked by examiners of the Commission, or as reported to the Commission, and covers their investment in other branches of the petroleum industry and also any investments they may have that are not a part of the petroleum business. The Commission has deducted the amount of their investments in pipe lines, refineries, marketing equipment, in securities of other companies and other outside investments from their entire net investment in order to show their net investment in the producing business. A revision of this net investment in the producing business has been made by the Commission. All appreciation shown by the compa-

nies' records or reported in schedules has been eliminated; adjustments have been made in the depreciation and depletion charges to conform to the Commission's method of treating these items in costs. (See p. 119). And other miscellaneous changes have been made, such as new or incidental drilling, and certain small items eliminated from cost and capitalized. The item new or "incidental drilling" includes the cost of drilling new wells, excepting the value of the physical property, and is largely the labor expense incident to drilling new oil wells, which was charged to the cost of production of crude petroleum by certain companies in accordance with income-tax regulations. Prior to 1918 this expense was capitalized by practically all companies. This latter practice has been followed by the Commission in order to secure uniformity of treatment for all companies and for the different years, and also to secure more accurate costs of production.

The net result of the revisions made by the Commission is a reduction in the net investment in the crude-petroleum producing business. The principal change is due to the adjustment of depreciation and depletion and to the elimination of appreciation, which increased from $40,799,000 on December 31, 1914, to $87,134,000 on June 30, 1919. The difference between the Commission's allowance for depreciation and that charged by the companies, which was added back to the investment, increased from $1,219,000 for 1914 to $15,485,000 for the first half of 1919. During the first four years the Commission's charge for depletion exceeded that made by the companies by from $114,000 in 1917 to $4,067,000 in 1916, while in 1918 and the first half of 1919 the companies' charge exceeded the allowance of the Commission by $6,982,000 and $11,561,000, respectively. The miscellaneous adjustments were small from 1914–1916, while beginning with 1917 they increased from $1,018,000 to $7,445,000 on June 30, 1919. During the later years this item increased the Commission's investment. This large adjustment for the last two and one-half years was almost entirely made up of the expense of new or incidental drilling which the companies had formerly capitalized, but which some companies during the last two and one-half years charged to costs instead of capitalizing them, under the option allowed by the Bureau of Internal Revenue.

The net investment in the oil business, as shown by the records and reports of the companies, increased from $191,433,000 in 1914 to $298,958,000 at the end of 1918. The total for June 30, 1919, was slightly lower, $293,015,000. This increase was partly due to the inclusion of a larger number of companies during the later years. The number of companies for which costs and investments are presented increased from 96 in 1914 to 134 in 1918 and then declined to 119 for June 30, 1919.

The net investment in the crude petroleum producing business, as determined by the Commission from the records of the companies or from reports submitted by them, steadily increased from $149,872,000 on December 31, 1914, to $240,371,000 on June 30, 1919. There was little change during 1915 but large increases in 1916 and 1917. The average net investment in the crude petroleum producing business for all companies for which investment is shown, as determined by the Commission, changed as follows from December 31, 1914–June 30, 1919:

TABLE 57.—*Net investment and net investment per company in the producing business, as revised by the Commission, 1914–June 30, 1919.*

Year.	Companies.	Net investment.	Net investment per company.
1914	96	$149,871,876	$1,561,165
1915	107	149,998,760	1,401,858
1916	116	175,153,075	1,509,945
1917	131	218,947,553	1,671,355
1918	134	235,102,020	1,754,493
1919 [1]	119	240,371,311	2,019,927

[1] June 30.

The average net investment per company in the crude petroleum producing business as revised by the Commission is much lower than that shown by the companies' records or reports. As already pointed out, this difference is largely due to the elimination of appreciation. The lowest average net investment per company was $1,402,000 for December 31, 1915, and the largest $2,020,000 for June 30, 1919.

NET INVESTMENT BY GROUPS.—The preceding discussion has been confined to the net investment for all companies combined. The following table shows the net investment as revised by the Commission by companies grouped according to the quantity of their annual production. The companies in group 1, which produced 1,000,000 barrels or over throughout the period covered by this report, increased their net investment in the producing business from $111,493,000 in 1914 to $186,180,000 for the first half of 1919. This group owned from 70.7 per cent to 77.5 per cent of the net investment for all companies, although it included only 7 companies out of 107 in 1915 and 11 out of 119 in 1919.

The following table shows the net investment by companies grouped according to the size of their annual production:

TABLE 58.—*Net investment in petroleum business, by groups, 1914–June 30, 1919.*

Year.	Group 1.		Group 2.		Group 3.		Group 4.		All groups.	
	Companies.	Producing over 1,000,000 barrels.	Companies.	Producing 250,000–1,000,000 barrels.	Companies.	Producing 50,000–250,000 barrels.	Companies.	Producing under 50,000 barrels.	Companies.	Net investment.
1914	10	$111,493,302	18	$18,094,731	38	$14,127,560	30	$6,156,283	96	$149,871,876
1915	7	105,992,147	20	20,074,617	35	12,565,169	45	11,366,827	107	149,998,760
1916	9	128,335,620	19	19,483,256	43	16,906,496	45	10,427,703	116	175,153,075
1917	10	162,912,616	19	20,014,502	49	22,575,042	53	13,445,393	131	218,947,553
1918	10	174,965,346	22	24,046,484	47	24,021,064	55	12,069,126	134	235,102,020
1919 [1]	11	186,179,655	22	25,072,932	39	17,149,925	47	11,968,799	119	240,371,311

[1] June 30.

As already stated, group 1 included more than 70 per cent of the net investment for each year. Group 2 was second in importance, except in 1917, when group 3 had a larger percentage and in 1918 when these two groups were practically the same. Companies in group 2 had from 9.2 per cent of the total net investment in 1917 to 13.4 in 1915, while group 3 owned from 7.1 per cent in 1919 to 10.3 per cent in 1917; while companies producing less than 50,000

barrels annually show a variation of from 4.1 per cent in 1914 to 7.6 per cent in 1915.

NET INVESTMENT PER BARREL.—There is a wide range in the net investment for the different groups of companies based on the quantity produced. This investment varies greatly for an individual company for different years, depending upon the fluctuations in the quantity of crude petroleum produced. The amount of the net investment per barrel is an important factor in connection with costs and earnings. In the preceding discussion of the cost of producing crude petroleum it has been shown that the depreciation and depletion costs per barrel were largest for the group having the smallest annual production. The average net investment per barrel for all companies covered for production costs varied from $2.51 in 1914 to $2.93 in 1917. During the period 1917–June 30, 1919, it remained practically constant, the variation being only from $2.91 to $2.93.

The following table shows the average net investment per barrel of crude petroleum produced for all companies from whom satisfactory information was secured for costs for the period 1914–June 30, 1919:

TABLE 59.—*Net investment per barrel based on annual production, by groups, 1914–June 30, 1919.*

Year.	Group 1: Producing 1,000,000 barrels or over	Group 2: Producing from 250,000 to 1,000,000 barrels.	Group 3: Producing from 50,000 to 250,000 barrels.	Group 4: Producing less than 50,000 barrels.	All groups.
1914	$2.43	$1.97	$3.71	$7.10	$2.51
1915	2.69	1.90	3.20	8.99	2.72
1916	2.61	2.19	3.64	8.58	2.73
1917	2.77	2.16	4.10	10.97	2.93
1918	2.77	2.28	4.26	9.25	2.91
1919 [1]	2.79	2.55	3.80	10.52	2.92

[1] First half of 1919 on annual basis.

The companies in group 2, which produce from 250,000 to 1,000,000 barrels annually, show the smallest investment per barrel for each year. The smallest amount during the period was $1.90 in 1915 and the largest $2.55 for the first half of 1919. Group 1 shows the second lowest average. The average net investment per barrel for this group increased from $2.43 in 1914 to $2.79 for the first half of 1919. In 1917 and 1918 the net investment per barrel was exactly the same, $2.77, while for the first half of 1919 it was $2.79. Groups 3 and 4 show much higher averages. The lowest net investment per barrel for group 3 was $3.20 in 1915 and the highest $4.26 in 1918, while that for group 4 varied from $7.10 in 1914 to $10.97 in 1917.

Section 8. Earnings from production.

METHOD OF COMPUTING EARNINGS.—The earnings of crude-oil producing companies generally are derived mainly from the sale of crude petroleum, but in addition thereto there are certain miscellaneous sources of revenue possessed by some of the companies.

This additional revenue is largely from the sales of casing-head gasoline and natural gas, with smaller items of income mainly due to royalties and rents received.

As the earnings reported by the different companies were not all on the same basis, it became necessary to put them on a comparable basis. This was done by taking the operating earnings reported by the various companies and adding back thereto such items as the Commission disallowed in costs as being more properly items which should be capitalized or charged to profit and loss or surplus. These were composed largely of such items as nonproductive drilling, lease rentals, interest, abandoned property, incidental drilling, and prospecting.

To the operating earnings thus obtained was added the net "Other income." This was obtained by deducting from "Other income" items charged direct to profit and loss by the Commission. The principal items comprising "Other income" have already been mentioned. The principal profit and loss deductions were for nonproductive drilling, lease rentals paid, and interest on short-term notes. Bond interest, interest on long-term notes, and interest on payables due subsidiaries were not deducted, as such obligations were treated as part of the company's investment. The company's total earnings before the adjustment of the depreciation and depletion charged by the company was thus obtained.

Depreciation was adjusted to 5 per cent on wells and equipment and 10 per cent on other operating property. Depletion was adjusted to 5 per cent on lands and leases, excluding nonproducing property.[5] The adjustment thus obtained was then added to or subtracted from the company's total earnings as described above and the company's total earnings adjusted for depreciation and depletion thus obtained.

As already stated, there were five large companies which were engaged in all branches of the petroleum business. Three of these companies furnished statements showing earnings by departments. For the other two companies the Commission has computed earnings for the producing department on the basis of the market price for the crude petroleum at the well.

EARNINGS BY GROUPS.—The same grouping of companies into four groups as in the discussion of cost of production is followed and needs no further explanation. (See p. 121.) The earnings by groups have been computed in accordance with the method already outlined. The only groups showing losses are those including companies having a small annual production, especially group 4, which produced only about 2 per cent of the total production of the State.

[5] For further description of the basis for depreciation and depletion allowed, see p. 119.

The following table shows the earnings obtained by groups for the period 1914–June 30, 1919.

TABLE 60.—*Earnings in producing business, as determined by the Commission, by groups, 1914–June 30, 1919.*

Year.	Group 1: Producing 1,000,000 barrels or over.	Group 2: Producing 250,000 to 1,000,000 barrels.	Group 3: Producing 50,000 to 250,000 barrels.	Group 4: Producing under 50,000 barrels.	All groups.
1914	$9,868,441	$1,908,780	[1] $116,826	[1] $248,660	$11,411,735
1915	5,409,762	1,922,761	[1] 103,643	[1] 488,574	6,740,306
1916	19,080,283	2,300,870	500,243	[1] 455,975	21,425,421
1917	34,038,839	3,717,577	1,232,487	[1] 215,324	38,773,579
1918	46,694,148	6,366,540	2,710,454	[1] 46,879	55,724,263
1919 [2]	26,930,179	3,364,719	1,059,843	44,137	31,398,878

[1] Loss. [2] First 6 months.

The above table shows that the earnings increased each year except in 1915, which was a less profitable year for the companies than 1914, due to an overproduction of crude petroleum and a consequent decline in its market price. The increased earnings in subsequent years is partly accounted for by the larger number of companies represented but mainly by improved market conditions.

EARNINGS FOR INTEGRATED COMPANIES.—The resolution directing this inquiry specifically requests information concerning the earnings of certain companies. There are five companies that are engaged in all branches of the petroleum business on the Pacific coast. These five companies are the Associated Oil Co., the General Petroleum Corporation, the Shell Co. of California, the Standard Oil Co. (California), and the Union Oil Co. of California. Three of these companies furnished departmental earnings for their crude petroleum producing business. These earnings have been revised by making certain adjustments, while crude oil departmental earnings for production for the other two companies were computed by the Commission on the basis of their crude oil sales at the average market price for the quality produced. Earnings are shown for three companies in 1914 and 1915, four in 1916, and five for the remainder of the period. The three companies for which departmental earnings are shown for the whole period are the Associated Oil Co., the Standard Oil Co. (California), and the Union Oil Co. of California. The earnings of the five companies computed on the above basis constituted from 61 to 65 per cent the total earnings for all companies for which earnings are presented.

These departmental earnings are shown in the following table:

TABLE 61.—*Earnings of the five large companies in the producing business, as determined by the Commission, 1914–June 30, 1919.*

Year.	Number of companies	Earnings.	Year.	Number of companies.	Earnings.
1914	3	$5,059,741	1917	5	$23,682,215
1915	3	2,986,523	1918	5	35,442,703
1916	4	11,660,291	1919 [1]	5	20,496,905

[1] First 6 months.

The earnings on crude petroleum production for the three companies were 44.3 per cent of the total for 1914 and 1915. In 1916 the earnings for the Shell Co. of California are also included, and the four companies had 54.4 per cent of the total. As already stated, the earnings of the five companies from 1917 to June 30, 1919, included from 61 to 65 per cent of the total.

EARNINGS PER BARREL.—The total earnings shown in Table 60 appear to be large, as they run into millions of dollars, in one year, 1918, attaining over $55,000,000. In order to show the meaning of these figures it is necessary to reduce them to a common unit, namely, the barrel of 42 gallons, which is the unit used in merchandising crude petroleum. The grouping used is the same as that shown in former tables. The margin per barrel for all companies varied from $0.114 in 1915 to $0.789 for the first half of 1919, while that for the companies having a large production was slightly higher, ranging from $0.129 to $0.849.

The table below shows the earnings per barrel, by groups, for the period 1914–June 30, 1919.

TABLE 62.—*Earnings per barrel of 42 gallons, by groups, 1914–June 30, 1919.*

Year.	Group 1: Producing 1,000,000 barrels or over.	Group 2: Producing 250,000–1,000,000 barrels.	Group 3: Producing 50,000–250,000 barrels.	Group 4: Producing 25,000–50,000 barrels.	All groups.
1914	$0.192	$0.171	[1] $0.034	[1] $0.304	$0.171
1915	.129	.161	[1] .030	[1] .218	.114
1916	.364	.248	.104	[1] .382	.316
1917	.527	.399	.241	[1] .188	.484
1918	.713	.586	.509	[1] .039	.672
1919 [2]	.849	.628	.486	.082	.789

[1] Loss. [2] First 6 months.

Group 1 shows the highest earnings of any group, except group 2 in 1915, ranging from $0.129 in 1915 to $0.849 for the first six months of 1919. Group 2 shows lower earnings than group 1 in every year except 1915, but higher earnings than group 3, varying from $0.161 in 1915 to $0.628 for the first six months of 1919.

Group 3 shows a loss in the first two years and a lower profit per barrel in the other years than groups 1 and 2, ranging from a loss of $0.034 in 1914 to a profit of $0.509 in 1918. Group 4 shows a loss for 1914 to 1918 ranging from $0.382 in 1916 to $0.039 in 1918, while the first six months for 1919 shows the only profit for the period, $0.082. The companies in this group produced less than 50,000 barrels a year.

RATE OF EARNINGS.—The real significance of earnings is recognized only as they are reflected in the return on the net investment. The rate of earnings has been computed on the mean investment, which is obtained by taking one-half of the sum of the net investment at the beginning and end of the year, except for 1914 and 1919, when the investment for December 31, 1914, and June 30, 1919, respectively, has been used.

The rate of earnings as shown in the following table for all companies as computed by the Commission ranged from 4.4 per cent in

1915 to 26.7 per cent for the first half of 1919. The earnings for the producers having an annual production of 1,000,000 barrels or over annually ranged from 5.1 per cent to 29.7 per cent, while those producing less than 50,000 barrels per year show a loss for every year excepting the first half of 1919, when they earned only seven-tenths of 1 per cent. The rate of earnings of companies engaged in producing crude petroleum, grouped according to the quantity of their annual production, is shown in the following table:

TABLE 63.—*Rate of earnings in producing business, as computed by the Commission, by groups, 1914–June 30, 1919.*

Year.	Group 1: Producing 1,000,000 barrels or over.	Group 2: Producing 250,000 1,000,000 barrels.	Group 3: Producing 50,000–250,000 barrels.	Group 4: Producing under 50,000 barrels.	All groups.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1914	8.9	10.6	[1] 0.8	[1] 4.0	7.6
1915	5.1	9.5	[1] .8	[1] 4.2	4.4
1916	15.1	12.0	3.0	[1] 4.3	12.4
1917	22.4	19.2	5.5	[1] 1.7	18.8
1918	27.5	28.1	11.4	[1] .4	24.4
1919[2]	29.7	27.3	12.3	.7	26.7

[1] Loss. [2] First 6 months, annual basis

The above table shows that in the years 1914 and 1915, during which the prices of crude petroleum were low as a result of an overproduction, that only groups 1 and 2, which include the larger companies, made any profit, while beginning with 1916 group 3 began to show a profit.

The five large companies, i. e., Associated Oil Co., the General Petroleum Corporation, the Shell Co. of California, the Standard Oil Co. (California), and the Union Oil Co. of California show a rate on their combined earnings for their crude-petroleum producing business ranging from 22.4 per cent in 1917 to 32.2 per cent for the first half of 1919. In 1914 and 1915 the rate for the combined earnings of the Associated Oil Co., the Standard Oil Co. (California), and the Union Oil Co. of California was 8.2 and 4.8 per cent, respectively, while in 1916, together with the Shell Co. of California, they earned 14.4 per cent.

The rate of earnings for the five large companies enumerated above are shown in the following table:

TABLE 64.—*Rate of earnings in producing business, as computed by the Commission, for five large companies, 1914–June 30, 1919.*

Year.	Number of companies.	Rate of earnings.	Year.	Number of companies.	Rate of earnings.
		Per cent.			*Per cent.*
1914	3	8.2	1917	5	22.4
1915	3	4.8	1918	5	29.7
1916	4	14.4	1919[1]	5	32.2

[1] First 6 months, annual basis.

The rate of earnings for the above companies was slightly less than the average for group 1 for the first three years, while for the last two years of the period their rate was higher.

RATE OF EARNINGS BY PROFIT GROUPS.—The rate of earnings by production groups has already been shown, but the rate of earnings by profit groups is also of great interest. For this purpose the companies have been grouped into those losing money, and then into groups with specified rates of profit, from one earning less than 10 per cent to a final group of those earning 50 per cent and over. The speculative character of the crude-petroleum business is shown by the very wide range in the earnings. In years when gushers are discovered some companies show very high earnings, while in each year a large number of companies lose money. From 1914 to June 30, 1919, from 17 to 56 per cent of all the companies for which information was secured show a loss while from 16 to 57 per cent of the companies earned in excess of 10 per cent. In every year some companies earned very large profits. A detailed analysis of the earnings for all companies covered by this report is shown in Appendix Table 42, while a summary analysis is given in Table 65 for 1914, 1918, and the combined results for the period 1914–June 30, 1919.

TABLE 65.—*Rate of earnings in producing business, by profit groups.*

Profit group.	Companies.		Proportion of total.			Rate of earnings by profit groups.
	No.	Per cent.	Net production.	Net investment.	Earnings.	
1914.			*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Losing money	47	48.9	17.9	42.9	[1] 10.0	[1] 1.8
Earnings—						
Less than 10 per cent	29	30.2	27.1	31.7	18.9	4.5
10 to 20 per cent	9	9.4	5.6	4.2	7.7	14.0
20 to 30 per cent	5	5.2	42.5	20.3	71.1	26.6
30 to 40 per cent	2	2.1	.7	.1	.6	32.6
40 to 50 per cent	2	2.1	1.8	.5	2.9	46.6
50 per cent and over	2	2.1	4.4	.3	8.8	230.8
Total	96	100.0	100.0	100.0	100.0	7.6
1918.						
Losing money	28	20.9	1.6	4.8	[1] .9	[1] 4.4
Earnings—						
Less than 10 per cent	34	25.4	5.8	16.4	1.8	2.7
10 to 20 per cent	25	18.6	19.3	26.4	15.6	14.3
20 to 30 per cent	19	14.2	22.4	22.9	23.0	24.5
30 to 40 per cent	8	6.0	7.1	6.0	8.8	36.0
40 to 50 per cent	6	4.5	12.9	6.6	12.9	47.7
50 per cent and over	14	10.4	30.9	16.9	38.8	55.8
Total	134	100.0	100.0	100.0	100.0	24.4
1914–June 30, 1919.[2]						
Losing money	43	36.6	9.0	19.9	[1] 3.5	[1] 2.6
Earnings—						
Less than 10 per cent	31	26.9	16.9	22.4	6.4	4.4
10 to 20 per cent	17	14.6	20.9	23.4	19.8	14.3
20 to 30 per cent	9	7.8	21.7	13.2	22.4	24.9
30 to 40 per cent	6	4.8	9.5	9.0	15.8	35.3
40 to 50 per cent	3	2.3	3.7	1.6	5.1	47.4
50 per cent and over	8	7.0	18.3	10.5	34.0	61.2
Total	117	100.0	100.0	100.0	100.0	16.1

[1] Loss.
[2] First 6 months of 1919 placed on annual basis by taking half of the investment.

The years 1914 and 1915 were years of low earnings. There was an overproduction in 1914 and the early part of 1915 and prices of crude petroleum were low. Beginning with 1916 earnings began to increase so that the average rate of earnings for all companies covered by the report had increased from 7.6 in 1914 to 24.4 per cent in 1918.

In 1914 out of 96 companies, 47, or almost one-half of those for which earnings are shown, had an average loss of 1.8 per cent on the net investment. These 47 companies produced 17.9 per cent of the net production of crude petroleum and owned 42.9 per cent of the net investment. In the prosperous year of 1918 there were still 28 companies, or almost 21 per cent of the total, that showed an average loss of 4.4 per cent. These 28 companies contributed only 1.6 pet cent of the net production and had only 4.8 per cent of the net investment. For the entire period 1914–June 30, 1919, there was an average of 43 companies out of 117, or 36.6 per cent, that show an average loss of 2.6 per cent. These companies produced only 9 per cent of the net production and owned a little less than 20 per cent of the net investment.

In 1914 there were 29 companies, or about 30 per cent, that earned less than 10 per cent on their net investment. Their average rate of earnings was only 4.5 per cent. This group produced about 27 per cent of the net production and owned 31.7 per cent of the net investment. The depressed condition of the crude-petroleum producing business in California at that time was strikingly shown when the results of the first two groups were combined. In that year 79 per cent of the number of companies covered by this report either lost money or earned less than 10 per cent, and they supplied 45 per cent of the net production covered by the above tabulation, and represented almost 75 per cent of the net investment. In 1918, 34 companies, or 25.4 per cent of the number shown, earned less than 10 per cent on their net investment. These companies contributed only 5.8 per cent of the net production covered and included 16.4 per cent of the net investment. Even in this prosperous year approximately 46 per cent of the companies showed either a loss or earned less than 10 per cent. These two groups, however, produced only 7.4 per cent of the net production and owned a little over 21 per cent of the net investment.

In 1914 five companies, producing 42.5 per cent of the total quantity included in the above tabulation and having 20.3 per cent of the net investment, earned from 20 to 30 per cent. In 1918 there were 19 companies that produced 22.4 per cent of the production covered and owned almost 23 per cent of the net investment that earned between 20 and 30 per cent; while for the whole period there was an average of 9 companies representing 21.7 per cent of the net production and 13.2 per cent of the net investment that earned from 20 to 30 per cent.

There were only 6 companies out of 96 in 1914 that earned in excess of 30 per cent; these companies produced only about 7 per cent of the net production shown, and represented only nine-tenths of 1 per cent of the net investment. Two of these companies show the highest average earnings for the entire period, namely, almost 231 per cent. In 1918 there were 28 companies, or approximately 21 per cent of the total number shown that earned in excess of 30 per cent.

These companies contributed a very substantial proportion of the net production, namely, almost 51 per cent, and they represented 29.5 per cent of the net investment. There were 6 companies in this year that earned from 40 to 50 per cent, with an average of 47.7 per cent, and 14 companies that earned in excess of 50 per cent, with an average of 55.8 per cent. For the entire period there was an average of 17 companies, or about 14 per cent of the total average number, that earned in excess of 30 per cent. They represented 31.5 per cent of the net production and about 21 per cent of the net investment.

In the early part of the period, particularly in 1914 and 1915, there were a large number of companies among those covered by this report, representing a large proportion of the net investment in the crude petroleum producing business, that were not receiving an adequate return on the investment. While the cost of producing crude petroleum was low, the price received for it was not sufficient to enable many producers to make any profit. Beginning in 1918 and continuing through 1919 the cost of production increased greatly, but the prices of crude petroleum increased at a more rapid rate, until some profit was realized on over 95 per cent of the net investment for all the companies included in the above tables. In a highly speculative mining business, such as the production of crude petroleum, there will usually be some producers that show a very high rate of earnings, while a considerable percentage show a loss. Normally those showing a loss for a given year include companies just developing their properties, and companies whose properties have been operated until only very small quantities can be produced, or companies that operate in unprofitable pools or in relatively unproductive portions of good oil pools.

COMPARISON OF COSTS, NET EARNINGS, AND INVESTMENT BY FIELDS.—The costs by companies and by fields have been presented in section 3, and investment and net earnings by different groupings have been discussed in the preceding paragraphs of this section. Appendix Table 43 shows the cost, investment, and net earnings per barrel, the rate of earnings and the average production per well by companies for 1918. For both the above-mentioned table and Table 66 below the average production per well was obtained by dividing the gross production by one-half of the sum of the number of wells being operated at the beginning and end of the year; the average investment per barrel was obtained by dividing the investment by the net production, and the rate of net earnings was secured by dividing the total amount of net earnings by the total investment. This table shows a very wide variation in each item for the different companies; the average production per well for 1918 varied from only 447 to 260,148 barrels, the costs varied from $0.14 to $5.36 per barrel, the investment per barrel from $0.46 to $80.41, the net earnings per barrel from a loss of $4.12 to a profit of $1.36, and the profit or loss on the net investment from a loss of 79.4 per cent to a profit of 129.5 per cent. As a rule the companies showing a loss had a small average production per well and a high average investment per barrel. The most profitable companies generally had a large average production per well and a low average investment per barrel. However, for both the unprofitable companies and those showing very large net earnings there were wide variations.

The following table shows the information discussed above grouped according to fields:

TABLE 66.—*Cost, net earnings, and investment per barrel and rate of net earnings on investment for petroleum producers in California, by fields, 1918.*

Field.	Number of companies.	Mean number of wells.	Annual gross production per well.	Average cost per barrel.	Net earnings per barrel.	Average investment per barrel.	Rate of earnings.
			Barrels.				*Per cent.*
Coalinga	26	554.0	17,184	$0.441	$0.724	$3.83	18.9
Kern River	14	343.5	2,862	.756	.422	3.09	13.7
Los Angeles and Salt Lake	4	132.5	4,251	.742	.195	3.45	5.7
Midway-Sunset	38	602.5	15,381	.652	.652	4.35	15.0
McKittrick	7	80.0	11,362	.380	.822	2.05	40.1
Santa Maria	7	88.5	17,240	.708	.308	4.41	7.0
Ventura-Newhall	9	112.5	8,154	.643	.747	8.01	9.3
Whittier-Fullerton	9	233.5	9,956	.438	.843	3.36	25.1
Nonseparable	20	3,487.0	15,680	.365	.788	2.57	30.7
Total	134	5,634.0	14,321	.428	.747	3.07	24.4

The McKittrick field shows the highest rate of earnings, the second highest net earnings per barrel, the lowest cost for a particular field, and the lowest average investment per barrel; although its production per well was below the average for all fields. The low cost of production in this field was partly due to the low investment per barrel, which affected the charges for depreciation and depletion. This low cost per barrel is reflected in comparatively high earnings per barrel and together with the small investment gives a high rate of earnings.

The Whittier-Fullerton field shows the second lowest cost, the largest earnings per barrel, the second highest rate of earnings, and the third lowest investment per barrel for a particular field. The high net earnings per barrel were due to a comparatively low cost and to the fact that a large proportion of the crude petroleum produced in this field is of high quality and commands a comparatively high price. These high net earnings, and the fairly low investment per barrel give a high rate of earnings.

The cost of production for the Coalinga field was only slightly higher than for the Whittier-Fullerton field. Its net earnings per barrel and rate of earnings were comparatively high. The production per well was much above the average but the investment per barrel was considerably higher than the average. The comparatively high net earnings per barrel and rate of earnings were largely due to the comparatively low cost. While the net earnings per barrel were high, the larger average investment per barrel gave this field a considerably lower rate of earnings than is shown for either the McKittrick or Whittier-Fullerton fields.

The Ventura-Newhall field shows a comparatively high cost of production; this was largely the result of its comparatively low average production and its extremely high investment per barrel. On the other hand, the earnings per barrel were high due to the higher prices paid for the high quality crude produced in this field, but the large investment per barrel gave a comparatively low rate of return.

While the Midway-Sunset field had a high average production per well, its comparatively high investment per barrel, through

depreciation and depletion charges, gave a high cost of production. The net earnings per barrel were quite large, but the high average investment per barrel gave this field a rate of earnings much below the average.

The Kern River and Los Angeles-Salt Lake fields had the smallest average production per well and the highest costs. The investment per barrel was about the average for the Kern River and slightly higher than the average for the Los Angeles-Salt Lake field. The net earnings per barrel were very low for the Los Angeles-Salt Lake field and much below the average for the Kern River field. This was due to the high costs and the character of the crude produced in these fields, which is heavy in the Kern River field and very heavy in the Los Angeles-Salt Lake field. The fairly low investment for the Kern River field gave it a higher rate than its earnings per barrel would indicate, while the rate for the Los Angeles-Salt Lake field was low.

The Santa Maria field shows the largest production per well, but had high costs on account of the large investment per barrel. The earnings per barrel were quite low due to the high cost and heavy character of the crude which gave it a low market price, while the high investment per barrel and comparatively low earnings per barrel were reflected in a low rate of earnings.

The nonseparable group, which includes the results for companies operating in two or more fields, shows a large average production per well, lower costs than for any particular field, low average investment per barrel, high earnings per barrel and a high rate of earnings on the net investment. As already stated, the companies included in this group own or lease the best oil lands in the State. The net earnings per barrel were slightly higher than the average for all companies, due to their lower costs, while the low average investment per barrel was reflected in a high rate of earnings on net investment.

CHAPTER VII.

TRANSPORTATION OF CRUDE PETROLEUM.

Section 1. Importance of transportation facilities.

The oil fields of California are mostly located far from the large centers of consumption of petroleum products, so that their development depends upon convenient, efficient, and cheap methods of transporting the crude petroleum to refining centers, which are generally located near centers of consumption. Three methods of transporting crude petroleum have been utilized in California, viz, (1) by water in barges and tank steamers, (2) by railroads in containers such as barrels or other receptacles or tank cars, and (3) by pipe lines. The first method—transportation by water—is economical, but it is limited largely to coastwise and overseas movements of crude. In some cases it is used to supplement pipe-line transportation. Even when the fields are near the coast the crude petroleum is first gathered by pipe lines. The second method of transporting crude petroleum—by railroad—is comparatively expensive. Crude petroleum is a low-priced commodity, i. e., it has a comparatively low value per unit of weight, hence it is charged a commodity rate, but fire risks and the expediency of using special cars for bulk shipment combine to make this method of transportation comparatively expensive. The transportation of crude petroleum by pipe lines was already the established practice in the industry when the production of petroleum in California began to attract attention. An extensive development and utilization of pipe lines in the Appalachian and other eastern fields existed in the early eighties, and since some of the original oil operators in California came from the eastern fields, similar methods were adopted for transporting the crude from the wells to the railroads, to the refineries, and to tidewater. The distribution of refined products and residuum from the refineries to the various consuming centers presents an entirely different problem, the solution of which is found in the utilization of such facilities of distribution as tank steamers, tank cars, and motor vehicles.

The scarcity of good rivers and harbors, the geographic location, and sparse population of the large oil-producing areas have rendered the use of pipe lines imperative in the State of California. Whenever an oil pool has been brought in and the development has shown that it was a producing area of importance, the large oil companies have provided pipe-line facilities to transport the crude to centers of consumption. while at the present time all of the important oil fields and oil pools are provided with adequate pipe-line facilities, the policy of the large companies in laying new lines has been a conservative one, and in California, as in the Mid-Continent field, pipe-line construction has followed the development of crude-oil production.[1]

[1] Pipe-Line Transportation of Petroleum, Federal Trade Commission, pp. 6 and 47.

ection 2. Development of pipe lines.

The development of petroleum production in Pico Canyon, Ven-ıra County field, and the rough and rugged character of the country ıd to the construction of a 2-inch pipe line in the early eighties to :ansport the crude to the neighboring town of Newhall, where a ɔfinery was constructed. This pipe line belonged to the Pacific oast Oil Co. About the same time the Mission Transfer Co. built 4-inch pipe-line from Santa Paula to the coast at Ventura, with naller lines from Santa Paula to the producing fields. The Western Jnion Oil Co. in the Santa Maria field and the Union Oil Co. of Cali-ɔrnia and the Puente Oil Co. in the Whittier-Fulleton field also vailed themselves of this form of transportation for local purposes. 'he rapid development in the San Joaquin Valley in the Kern River nd the Coalinga fields in the opening years of the twentieth cen-ury led to a larger utilization of pipe lines, because the refineries t that time (1900–1905) were centered around San Francisco Bay nd the city of Los Angeles rather than in the oil fields. It was under uch circumstances that the Pacific Coast Oil Co., then controlled y the Standard Oil Co. (New Jersey), in 1902–3 constructed an -inch pipe line from the Kern River field to Richmond on San 'rancisco Bay, with a branch line tapping the Coalinga field. The riginal line was 280 miles in length while the distance from the oalinga field to the junction with the main trunk line was 29 miles.

In 1903–4 a 6-inch line (known as the Matson line), 110 miles in ngth, was constructed from the Coalinga field to Monterey on the ɔaboard. Before this the numerous small producers of the San ɔaquin Valley had been entirely dependent upon the pipe line of ıe Pacific Coast Oil Co. and upon railroads for the transportation their production to the markets on the coast. The Matson line as sold to the Associated Oil Co. in 1905.

Other developments at this time included the Santa Maria field, here a 6-inch pipe line, 32 miles in length, was constructed by the acific Coast Oil Co. in 1905. The Union Oil Co. of California had ɔen operating in this field for some time and constructed another pe line about the same time, while a small local company built a ırd short pipe line extending to the coast. The Associated Oil Co. so has a pipe line from the same field extending to the coast at aviota.

The next important development was in 1907–8, when an 8-inch pe line was built from the Kern River field to Port Costa, on San rancisco Bay, by the Associated Pipe Line Co., owned jointly by ıe Associated Oil Co. and the Southern Pacific Co. This pipe line as constructed with "rifled" pipe, which subsequently was replaced r ordinary pipe. The rapid development of the Midway-Sunset field this time caused the Standard Oil Co. (California) to build a branch ıe from that field to their 8-inch line from the Kern River field, while e Associated Pipe Line Co. did the same thing by way of the Coalinga d McKittrick fields.

In 1909 the Union Oil Co. of California, in conjunction with the dependent Oil Producers Agency, formed the Producers' Trans-ɪrtation Co., and constructed an 8-inch pipe line from the San aquin Valley across the mountains to tidewater at Port San Luis. ıis line, with branches to all the fields in the San Joaquin Valley, ıs an aggregate length of about 220 miles for the system. The pro-

lific production in Midway-Sunset field in 1910, when Lakeview Well No. 1 came in, immediately created a demand for more transportation facilities, and the Standard Oil Co. (California) doubled its entire line to Richmond, and subsequently the Union Oil Co. of California did likewise to Port San Luis.

During 1911 the Standard Oil Co. (California) built a pipe line in the southern district from the Whittier-Fullerton field to the coast at El Segundo, while the Union Oil Co. of California extended its pipe lines to the Whittier-Fullerton and adjacent fields. The Amalgamated Oil Co., a subsidiary of the Associated Oil Co., also had a pipe line 10 miles in length connecting the Salt Lake field with its refinery at Los Angeles.

In 1912–13 the General Pipe Line Co. of California, which is owned by the General Petroleum Corporation, constructed an 8-inch pipe line running south from the Midway-Sunset field across the Tehachapi Range to the refinery of the latter company at Vernon, with a branch from Lebec to Mojave on the Santa Fe Railroad, the total length of these lines being 212 miles.

In 1915 the Valley Pipe Line Co. controlled by the Shell interests, constructed an 8-inch pipe line from the Coalinga field to Martinez, on San Francisco Bay, a distance of 170 miles. At the beginning of 1918 this pipe-line property was taken over by the Shell Co. of California, and the Valley Pipe Line Co. was dissolved.

In addition to the larger developments outlined above there have been many minor extensions, adjustments, and removals of pipe lines during the past decade, e. g., the Standard Oil Co. (California) has recently removed a pipe line which it had in the Santa Maria field.

Section 3. Principal pipe-line systems.

IMPORTANT SYSTEMS.—There are five large pipe-line systems in California which transport the great bulk of the crude petroleum moved by pipe lines. These systems are owned or controlled by the Standard Oil Co. (California), the Union Oil Co. of California, the Associated Oil Co., and the Southern Pacific Co. jointly, the Shell Co. of California, and the General Petroleum Corporation. The Standard Oil Co. (California) owns and operates its own lines, the Union Oil Co. of California owns and operates its own lines, while it also owns and operates the Producers' Transportation Co., the Associated Oil Co., and Southern Pacific Co. control jointly the Associated Pipe Line Co., the Shell Co. of California owns and operates the pipe lines which were built by the Valley Pipe Line Co., while the General Petroleum Corporation controls through stock ownership the pipe lines of the General Pipe Line Co. of California. The main trunk lines and their important branches are shown on Map 1, opposite page 46.

As shown on this map, three pipe-line systems connect the oil fields of the San Joaquin Valley with the refineries situated on San Francisco Bay. These pipe lines are operated by the Standard Oil Co. (California), the Associated Pipe Line Co., and the Shell Co. of California, respectively. Three other lines extend from these same fields to the coast at Monterey, Port San Luis, and San Pedro. These pipe lines are owned by the Associated Oil Co., the Union Oil Co. of California, and the General Pipe Line Co. of California, respectively. Thus, the San Joaquin Valley fields may be considered as the base

of operations for six distinct trunk pipe lines, with an aggregate daily capacity of 250,000 barrels. This indicates a capacity of at least 7,500,000 barrels per month, or about 90,000,000 barrels per annum, which exceeds the greatest production that has been obtained up to the present time from the San Joaquin Valley fields by about 13,000,000 barrels.

In the Santa Maria field there are three short trunk pipe lines operated by the Associated Oil Co., the Union Oil Co. of California, and by a small local company, respectively. The pipe line of the Standard Oil Co. (California), which was constructed in 1905, has been removed recently. This field is evidently well supplied with pipe-line facilities. In the Ventura fields the Union Oil Co. of California and the Standard Oil Co. (California) have pipe lines terminating at the coast at Ventura, which extend to the many small pools found throughout this field. These lines are usually smaller than the standard sizes in use elsewhere, but the pipe-line facilities are adequate to handle the current production.

In the southern district the Standard Oil Co. (California) and the Union Oil Co. of California operate pipe lines extensively, while the Associated Oil Co. and the General Pipe Line Co. of California are also represented. In addition to these lines several shorter lines are operated by smaller companies. The pipe lines in this section of the country are comparatively short, as the production of crude petroleum is secured from pools adjacent to the coast. The country is generally level, and hence the construction and operation of the various pipe lines is comparatively easy.

CAPACITY AND MILEAGE.—The trunk pipe-line systems owned and operated by the five large interests include the bulk of the pipe-line mileage and pipe-line capacity in the State of California. The mileage for the principal sizes of pipe and the capacity are shown for each company as of December 31, 1919, in the following table:

TABLE 67.—*Trunk pipe-line mileage, capacity, and principal sizes of pipe owned or controlled by five large companies, Dec. 31, 1919.*

Company.	Trunk line mileage.				Daily capacity.
	8-inch.	6-inch.	Other sizes.	Total miles.	
					Barrels.
Standard Oil Co. (California)	697	43	173	913	122,000
General Pipe Line Co. of California[1]	212	.....	.....	212	30,000
Shell Co. of California	170	.....	.....	170	30,000
Associated Oil Co.	619	104	.....	723	103,000
Union Oil Co. of California	321	82	18	421	95,000
Total	2,019	229	191	2,439	380,000

[1] Owned by the General Petroleum Corporation.

The total trunk pipe-line mileage controlled by the five large companies aggregate 2,439 miles, of which 2,019 miles are 8-inch pipe, 229 miles are 6-inch pipe, and the remaining mileage includes miscellaneous sizes, such as 3, 4, 10, and 12 inch pipe. The small pipe might be more properly regarded as gathering lines in accordance with the practice in the Mid-Continent and Eastern fields. The rated capacity reported by the several companies is sufficient to transport

138,700,000 barrels of crude petroleum per annum. This quantity is considerably in excess of the present annual production for the State, which in 1920 was 105,721,000 barrels.

Section 4. Operation and construction cost.

PROBLEMS PECULIAR TO CALIFORNIA.—The principles of pipe-line construction are treated exhaustively in the report on Pipe-Line Transportation of Petroleum, published by the Commission in 1916. However, in California it was found that the methods which had been successful in the Mid-Continent and Eastern fields did not always give satisfactory results. This was largely due to the difference in the character and quality of the crude petroleum produced in California as compared with that produced in Eastern fields. The transportation difficulties in California were confined to the heavier grades of crude, and particularly to those produced in the Kern River field and Casmalia pool of the Santa Maria field. The crude petroleum produced in these two fields is heavy and very viscous (sticky); hence it does not flow readily through pipe lines, especially in cold weather. In order to maintain the efficiency of any line used to transport these crudes, it was found necessary to modify the construction of the pipe-line system and the method of pumping the crude petroleum, especially in two particulars: (1) Equipment was installed at pumping stations to heat the crude petroleum to decrease its viscosity, and (2) the distance between pumping stations was greatly reduced.

METHOD OF HEATING.—Heating crude petroleum in order to transport it successfully through pipe lines is not necessary in any of the oil fields east of the Rocky Mountains, but is necessary in order to transport the heavier and more viscous crudes in California efficiently. The equipment at each pumping station is devised to increase the temperature of the crude from the normal temperature of from 60° or 80° to 150° or 160° F. Between stations the crude oil cools perceptibly and must be heated again. A minimum temperature of 100° F. is sought for the oil in transit, to maintain which the pumping stations must be comparatively close together, because the maximum temperature can not be increased above 150° or 160° F. without causing gasification and pumping difficulties. Some pipe lines have been wrapped with asbestos and others painted, then wrapped with burlap and painted again, in order to conserve the heat. By heating the heavy crude its movement is greatly accelerated, and the pipe line can be operated at normal capacity.

DISTANCE BETWEEN PUMPING STATIONS.—The average distance between trunk-line pumping stations in the Mid-Continent field as shown by the Commission's report on Pipe-Line Transportation of Petroleum (p. 56), is about 40 miles, but it was soon found that for heavy California crude, pumping stations 30 miles apart, even when the crude was heated, were too distant from each other to be operated successfully. The Pacific Coast Oil Co. built the first pipe line in California, which was constructed to transport heavy crude petroleum. This was an 8-inch line from the Kern River field to San Francisco Bay. Pumping stations were placed 28 or 30 miles apart, and "heaters" were installed at each station. The line was put in operation in March, 1903, when the ground was still cold, and by the time the crude had been pumped 15 miles it had lost all of the heat put into it at the station. Although the pumps were forced to the

highest pressures that could be safely used, this line, which should have transported 25,000 barrels per day in the Mid-Continent field, delivered only about 1,000 barrels per day. Even in the hot weather of the following summer it could not be operated at its full capacity. In the fall of 1903 the problem of transporting this heavy crude was solved by placing intermediate pumping stations with heating equipment on the entire line. Later, in 1907–8, an extension was built into the Midway–Sunset field, and on this branch and on the original line there are 22 pumping stations for a distance of 313 miles, or an average distance between the stations of about 15 miles.

OTHER METHODS OF FACILITATING TRANSPORTATION.—Several other expedients have been tried to accelerate the flow of heavy crude petroleum through pipe lines, some of which have been successful. When the Associated Pipe Line Co. built its pipe line from the San Joaquin Valley fields to San Francisco Bay, in 1908–9, it tried rifled pipe. This pipe had a spiral groove like a rifle barrel, and water was put in the line with the crude petroleum, which was expected to form a film between the crude and the pipe and thus facilitate the flow. This method was found unsatisfactory, however, because the water and oil could not be readily separated when the terminus was reached and later the rifled line was replaced by ordinary pipe. Other means of accelerating the transportation of the heavy crude petroleum in pipe lines have been to mix light crude with heavier grades, the use of an auxiliary steam line for heating purposes, and by treating the heavy crude by cracking before shipment.

CAPACITY OF PIPE LINES.—The carrying capacity of a pipe line used for the transportation of crude petroleum varies greatly, according to the size of the pipe, the distance between pumping stations, the pumping pressure used, the viscosity, and, particularly for heavy crudes, the temperature of the crude petroleum transported. Especially in the case of heavy viscous crudes in California the temperature of the oil changes the viscosity greatly, and, as already shown, the quantity of crude petroleum transported through a given pipe line can be increased many fold by increasing the temperature to 160° F. The principal sizes of pipe used on trunk lines are 6 and 8 inches in diameter, with some 10 and 12 inch pipe used for loops; while the working pressure usually varies from 600 to 800 pounds per square inch. An 8-inch pipe line in the Mid-Continent field, working at ordinary pressure with pumping stations 40 miles apart, will deliver about 21,000 barrels of crude petroleum daily, while a typical 8-inch pipe line in California using heat and pumping stations about 15 miles apart will deliver 30,000 barrels daily. To illustrate the extremes in operating with light and heavy crude petroleum under varying atmospheric temperatures, a given line pumped 18,000 barrels of light oil daily in warm weather, while the same line in cold weather transporting heavy viscous crude, averaged as low as 800 barrels daily.

COST OF PIPE LINES.—Pipe lines which are equipped to transport heavy viscous crude petroleum in California require a large investment per mile. The fixed investment in the line of the Shell Co. of California is given in the following table:

TABLE 68.—*Fixed investment in the trunk pipe line of the Shell Co. of California, Dec. 31, 1917.*

Item.	Shell Co. of California.	Item.	Shell Co. of California.
Land	$42,395.44	Miscellaneous and tanks	$22,783.95
Rights of way	97,159.74	Piping	185,879.68
Line pipe	735,498.78	Auxiliary machinery	146,461.36
Line pipe fittings	29,757.12	Oil tanks	295,402.64
Pipe line construction	531,919.36	Delivery facilities	836.53
Buildings	362,167.33	Telegraph and telephone lines	67,637.91
Boilers	130,192.78	Highway equipment	18,490.91
Engines and pumps	372,708.37	Other property	5,084.77
Water supply	141,632.07		
Electric wiring	9,528.23	Total	3,196,317.27

The fixed investment shown above was furnished by the company and shows the comparative expensiveness of pipe-line investment in California. The fixed investment for the Shell Co. of California equals an investment of about $16,800 per mile for this 170-mile line, and as this line was built in 1915 it represents a prewar cost.

The investment for the Union Oil Co. of California for its 420 miles of trunk pipe line was $9,050,140.30 at the end of 1917, or an average of about $21,500 per mile. However, the item of "oil tanks" in this company's statement apparently includes storage facilities at tank farms, which are greatly in excess of the storage required as working tanks at the pumping stations for purely transportation purposes. Assuming that at least 50 per cent of this storage item is not properly a pipeline facility, as is evidently the case, the cost would average $18,500 per mile. The pipe lines of this company were all constructed many years ago. (See p. 153.) Some of the pipe lines consist of pipe of smaller sizes, particularly in the Ventura County field. Such pipe is not as expensive as 8-inch pipe.

The General Pipe Line Co. of California, which is owned by the General Petroleum Corporation, had a fixed investment of $4,930,495 in 1915, representing 212 miles of 8-inch pipe line, or an average of $23,250 per mile. This pipe line was constructed in 1912–13, when prices were much lower than now. The line crosses the Tehachapi Range at a high elevation, where the rough and rugged character of the country would tend to make construction costs unduly high as compared with other pipe lines laid in the San Joaquin Valley, where the country is level and railroad transportation facilities are available for the movement of the requisite pipe and equipment. No comparative figures are available to show the fixed investment per mile for the Standard Oil Co. (California) or for the Associated Oil Co. and its subsidiaries.

These construction costs per mile exceed the cost of similar developments in the Mid-Continent field, where the pipe-line construction before the war cost approximately $7,000 per mile and the pumping stations $3,250 per mile, which for prewar construction gives a total of about $10,250 per mile. However, one pumping station in the Mid-Continent field pumps the crude petroleum about 40 miles, or

an average of more than two and one-half times as far as in California. Hence, it is evident that the erection of so many pumping stations equipped with heating facilities is one of the principal reasons for this difference in cost. The topography of the country is also an important factor. In the Mid-Continent field most of the large trunk lines have been built on or near railroad rights of way and there are no mountain ranges to cross.

OPERATING METHODS.—In California, for transportation purposes, the pipe-line companies classify all crude petroleum transported as heavy crude or light crude. The dividing point varies with the several companies from 17.9° to 22° Baumé. These grades are stored separately and the minimum runs of any given grade are kept as high as possible, in the case of the Standard Oil Co. (California), at a minimum of 100,000 barrels.

In operating "hot" lines, great care must be taken to allow the heated pipe line to cool and contract gradually before any crude at atmospheric temperature is pumped through the line, otherwise there is great danger of breaking the line or stripping the threads.

Section 5. The pipe-line law and common-carrier decisions.

COMMON-CARRIER LAW.—The Hepburn amendment to the interstate commerce act, passed by Congress in 1906, making pipe-line companies engaged in interstate transportation common carriers, apparently did not affect the operation of petroleum pipe lines in California, because all of the large systems were located entirely within the State. Therefore, the California State Legislature, on June 4, 1913, approved the pipe-line common-carrier law, which was entitled "An act declaring certain corporations, individuals, or associations of individuals engaged, directly or indirectly, in the transportation of crude oil or petroleum or the products thereof, for hire or otherwise, to be common carriers and public utilities, and subject to the provisions of the act known as the public utilities act of the State of California, approved December 23, 1911." [2]

Under this act every private corporation and every individual or association of individuals operating any pipe line or part of any pipe line, for the transportation of crude petroleum, directly or indirectly, for the public for hire, or when such pipe lines were constructed or maintained upon, along, over or under any public highway, or in favor of whom the right of eminent domain had been exercised in the acquisition of their right of way, or where any corporation, association of corporations, individuals or association of individuals, were able to secure, or attempted to secure a monopoly of the purchasing of or transportation of petroleum, were declared common carriers.

ATTITUDE OF THE STANDARD OIL CO. (CALIFORNIA).—On August 11, 1913, the California State Railroad Commission issued an order stating that after preliminary investigation it appeared that certain corporations might be subject to the provisions of the law, and requiring such corporations to appear before the railway commission "to show cause why the railway commission should not make its order requiring each of said companies to file with this Commission schedules of their rates and charges." [3]

[2] Chap. 327, Statutes of 1913.
[3] California State Mining Bureau Bulletin 60, Petroleum Industry of California, p. 477.

On August 14, 1913, in response to the above order of the California State Railroad Commission, the Standard Oil Co. (California) filed complete schedules of rates and regulations for the transportation of crude petroleum through its lines as a common carrier. The company filed these schedules under protest, and in a statement filed with the railroad commission declared that it had at no time used its pipe lines to transport any crude petroleum except that which it had produced or purchased, and that it had never accepted compensation, in any form, for the use of its pipe lines. It also stated that all of its pipe lines had been laid over rights of way purchased by the company, and while its lines crossed public highways at different points, that all such crossings had been made with the consent of the authorities, and the pipes had been placed and buried as directed by such authorities. A summary statement was made regarding pipe line and refining capacity of the company, in which it was asserted that it used about 30 per cent of the total production of the State. After calling attention to the fact that it had the alternative of either becoming a common carrier, or, if it remained a private carrier, of obtaining an annual license and paying a fee of 50 cents per barrel for every barrel of crude petroleum transported across the public highways, the company elected to become a common carrier and concluded its statement as follows:[4]

> In constructing the pipe lines above described, which grew with the development of the oil fields, the company was forced to cross highways which intersected its private right of way. These crossings it can no longer use, in compliance with the act mentioned, without making the payments required thereby, unless the lines are operated for common carriage. But to maintain its pipe lines the company must continue to cross the highways. It can not pay the said fees or exactions and continue in business. Its lines are therefore forced into a service which the company has neither sought nor which it could be lawfully compelled to render.
>
> Under these conditions the company will, from and after the 10th day of August, 1913, own, operate, manage, and control its pipe lines for the transportation of crude oil, and will engage in the business of transporting crude oil or petroleum, by its pipe lines, as a common carrier, and it will further in every reasonable way the performance of the business which it thus engages to do, and will, so far as it can, facilitate the supervision and regulation of that business by the Railroad Commission of the State of California, while said chapter 286 is in force and binding thereon.

COMMON-CARRIER DECISIONS.—The Associated Oil Co. and Associated Pipe Line Co., which is jointly owned by the Associated Oil Co. and the Southern Pacific Co., and the Producers' Transportation Co., which is controlled by the Union Oil Co. of California, each brought suit against the California State Railroad Commission to prevent that commission from requiring them to act as common carriers. In the case of the Associated Oil Co. and the Associated Pipe Line Co. *v.* the Railroad Commission of California, the California State Supreme Court decided in favor of the pipe line company, while the same court decided in favor of the railroad commission in the case of the Producers' Transportation Co. This latter case was appealed to the United States Supreme Court and the decision of the lower court was affirmed. Hence, in the case of these two pipeline companies, one, the Associated Oil Co.-Associated Pipe Line companies,[5] has been judicially declared a private carrier, while the Producers' Transportation Co.[6] has been held to be a common carrier. Although the Producers' Transportation Co. was declared a common

[4] Standard Oil Bulletin, September, 1913.
[5] 169 Pacific Reporter, 62.
[6] 251 U. S., 228.

carrier by decree of the Supreme Court of the United States on January 5, 1920, the attorney for the Railroad Commission of California stated to a representative of the Federal Trade Commission a year later that the railroad commission had not followed up the decision in this case and had not required the Producers' Transportation Co. to file pipe-line rates.

Section 6. Pipe-line rates, regulations, and cost of operation.

EARLY HISTORY OF RATES.—As already stated, Congress in 1906 passed the Hepburn Act amending the interstate commerce act making pipe lines engaged in interstate transportation common carriers and placing them under the jurisdiction of the Interstate Commerce Commission. The constitutionality of this act was attacked in the so-called "pipe-line cases," and the question was carried to the United States Supreme Court, which rendered its decision on June 22, 1914, upholding the Hepburn Act. Prior to this decision some pipe-line tariff schedules had been filed with the Interstate Commerce Commission. The primary principle in rate making, which was adopted by the eastern pipe-line companies at that time, was to follow the published railroad rates. No attempt was made to approximate the rates to the cost of the service together with a reasonable return on the investment. This practice was followed by all the eastern pipe-line companies. For example, in 1904 the pipe line and railroad rate from Griffith, Ind., to Buffalo, N. Y., a distance of 606 miles by pipe line, was 19.5 cents per 100 pounds by both rail and pipe line.[7] Among other considerations tending to make such a basis for pipe-line rates the rule, was the fact that pipe lines were frequently constructed on the rights of way belonging to the railroads, although there was no community of interest in the ownership of the pipe line and the railroad. Instances are also found where railroads increased their rates for the transportation of crude oil after a pipe line had been built along their right of way, and when a pipe-line schedule was filed it named the same rate as the increased railroad rate.[8]

The pipe line of the Pacific Coast Oil Co. from the Kern River field was laid along the line of the Southern Pacific Co. for many miles and the contract authorizing the use of the right of way by pipe-line company contained the stipulation: "It also being the express understanding * * * that the pipe line * * * is only to be used * * * for its own oil * * *." The rate established for the transportation of oil at that time was a constructive charge for pipage and corresponded exactly with the freight rate for the same haul. These pipe-line charges have always been intercompany or interdepartmental in California.

After the Supreme Court had rendered its decision in the pipe-line cases, on June 22, 1914, schedules were filed by all companies engaged in interstate transportation of crude petroleum by pipe line. These new schedules named substantially lower rates for pipe-line transportation than were charged by railroads between the same points. The pipe-line rates for long distances, as for example, from the principal shipping points in Oklahoma to the Atlantic seaboard were

[7] Report of the Commissioner of Corporations on The Petroleum Industry, pt. 1, pp. 242-245.
[8] Federal Trade Commission Report on Pipe-Line Transportation of Petroleum, p. 446.

approximately one-half those charged by the railroads, while for intermediate points, such as Cleveland, Ohio, Buffalo, N. Y., and Pittsburgh, Pa., the pipe-line rates were from 55 to 60 per cent of the railroad rates.[9]

It was an early practice, which is still in use, for the eastern pipe lines, particularly in the Appalachian field, to allow a shipper to retain title to his crude petroleum after it has been received by the pipe-line company. The shipper was issued a "credit-balance" or received a "pipe-line certificate" for the crude which might be sold in the open market. This practice has never existed in the Mid-Continent or other western fields. In these sections the crude petroleum in the pipe line has always belonged to the crude purchasing company. This latter condition is found in California.

RATES PER BARREL.—Pipe-line rates for common carrier shipments have been named by three companies, viz, General Pipe Line Co. of California, Shell Co. of California, and the Standard Oil Co. (California). These rates are shown in Appendix Table 44.

While schedules naming rates and regulations governing transportation of crude petroleum have been on file, in some cases since 1913, as a matter of fact the pipe lines have not been operated as common carriers.

REGULATIONS GOVERNING SHIPMENTS.—Pipe-line regulations governing the transportation of crude petroleum are often as significant as the rates themselves. In general there are four conditions imposed upon pipe-line shipments which are not required for shipment by rail. Those requirements cover: (1) The minimum quantity of petroleum received for transportation; (2) the quality of the petroleum accepted for shipment; (3) identity of crude petroleum delivered; (4) loss of crude in transit.

The minimum quantity specified in the schedules governing shipments which have been filed by California pipe-line companies varies from 10,000 barrels in the case of General Pipe Line Co. of California to 100,000 in the case of the Standard Oil Co. (California).

All of the schedules filed by California companies specify that the crude petroleum shall be of the same kind and gravity and that impurities, such as sand and water, shall not exceed 3 per cent. This requirement varies greatly for crude petroleum from different fields. The heaviest crude petroleum which will be accepted for transportation by pipe lines varies from 15° Baumé in the Midway-Sunset field to 22° Baumé for shipment from the Pico Canyon pool.

In transportation by rail the shipper receives the identical crude petroleum shipped, while the pipe-line companies do not obligate themselves to deliver even the same quality of crude as they have accepted for shipment. For example, the schedule of the Standard Oil Co. (California) contains the following:

> All such crude petroleum will be accepted for transportation only on condition that it shall be subject to such changes in kind and gravity while in transit as may result from the mixture of said crude petroleum with other crude petroleum in the pipe lines or tanks of this company.

The pipe-line schedules provide that the pipe-line company shall deduct 2 per cent to cover loss in transit. In addition, the pipe-line companies make a pro rata deduction from all oil in transit in case of

[9] Federal Trade Commission Report on Pipe-Line Transportation of Petroleum, p. 446.

unusual loss caused by breakage of pipe lines, leakage in tanks and pumps, and other causes over which they have no control.

COST OF TRANSPORTATION.—The Commission has not made a detailed study of the cost of transporting crude petroleum by pipe line in California. An exhaustive report on such costs involves detailed information covering pipe-line investment, the cost of operation, and the quantity and distance the crude petroleum is transported. However, five of the large pipe-line companies operating in California furnished some information on pipe-line costs, three of which have filed schedules as common carriers. The cost of the operation of certain pipe lines, as reported by the principal pipe-line companies, is shown in Appendix Table 45.

The Standard Oil Co. (California) owns and operates directly all the pipe-line mileage listed under its name. The Associated Oil Co. owns the pipe line from the Santa Maria oil field to the Gaviota refinery, while the pipe line from the San Joaquin Valley oil fields to Avon is operated by the Associated Pipe Line Co., which company is controlled jointly by the Associated Oil Co. and the Southern Pacific Co. The General Petroleum Corporation controls the General Pipe Line Co., which owns and operates the pipe lines transporting crude petroleum for the parent company. The Shell Co. of California controlled the Valley Pipe Line Co., which owned and operated the Coalinga-Martinez pipe line during the period 1915–1917. Since that time this line had been owned by the Shell Co. of California. The Union Oil Co. of California owned a controlling interest in the Producers' Transportation Co., which owned and operated the San Joaquin Valley-Port San Luis pipe line during 1915–16, but during 1917–1919 the pipe-line assets of this company have been reported in the statements of the parent company. The pipe line from Santa Maria to Port San Luis has always been owned and operated by the Union Oil Co. of California directly.

The Standard Oil Co. (California) reported a separate cost for the heavy and light crudes. This company includes in its heavy crude petroleum all crude 17.9° Baumé and lower, while the light crude includes all 18° Baumé or higher. Their cost for transporting the heavy crude is uniformly about 10 per cent higher than that for light crude.

The reported costs for all of the lines shown in the table except for the Shell Co. of California increased greatly from 1914 to 1919. The Standard Oil Co. (California) shows an increase in cost of about 50 per cent from 1914 to 1919 from the San Joaquin Valley fields to their Richmond refinery on San Francisco Bay, while the cost for shipments from the Whittier-Fullerton field to the El Segundo refinery near Los Angeles remained practically the same throughout the period, due to increased volume transported during the later years. The Union Oil Co. of California shows the greatest increase—over 120 per cent. The reported costs of the Associated Oil Co. increased almost 100 per cent from 1914 to 1919, and those for the General Pipe Line Co. of California increased 70 per cent from 1915 to 1919. The reported costs for the Shell Co. of California shows an abnormally high cost for 1915, while from 1916 to 1919 their reported costs remain practically the same.

Although the costs as reported by the companies generally increased, the rates which the companies allow their pipe-line depart-

ments or subsidiary companies remained unchanged throughout the period, except in the case of the Shell Co. of California, in which case the rate was increased from 15 to 25 cents per barrel in February, 1918. Hence the margin between the reported cost per barrel and the pipe-line rate per barrel is as a rule much smaller in 1919 than in 1914.

The distance transported and the quantity of crude piped by the several pipe-line companies is not available; therefore no adequate and satisfactory comparison can be made between the charges for this transportation service and the reported cost. Three pipe-line systems are available for use in the San Joaquin Valley fields, while two other pipe lines extend to portions of this crude-oil area. The Standard Oil Co. (California), the Associated Pipe Line Co., and the Union Oil Co. of California operate pipe-line systems extending to all oil pools in the San Joaquin Valley; the first two charge 35 cents per barrel for delivery at points on San Francisco Bay. The greatest distance that the crude is transported by pipe line is that by the Standard Oil Co. (California) from the Midway-Sunset field by way of the Kern River field to San Francisco Bay, a distance of 313 miles, while the Associated Pipe Line Co. has a more direct line, but its nominal charge is the same, i. e., 35 cents per barrel. The Union Oil Co. transports its crude from the San Joaquin Valley westward to Port San Luis, and thence by tank steamer to San Francisco Bay. The rate for the pipe line service is 22½ cents per barrel and the marine charge is 10 cents, giving a total cost of 32½ cents as compared with the rate of 35 cents quoted for the other two companies mentioned above. The rate for the line now owned by the Shell Co. of California was 15 cents per barrel from the Coalinga field to San Francisco Bay, but early in February, 1918, this rate was increased to 25 cents.

The pipe line controlled by the General Petroleum Corporation formerly carried the crude oil south from the Midway-Sunset field to Vernon, where it was refined. The rate for this service was 25 cents per barrel. More recently, however, the crude supply for the Vernon refinery has been obtained from the Whittier-Fullerton field. Other pipe-line operations shown in the table include the line of the Standard Oil Co. (California) from the Whittier-Fullerton field to the El Segundo refinery; the Associated Oil Co.'s pipe line from the Santa Maria field to Gaviota and the pipe line of the Union Oil Co. of California from the same field to Port San Luis. The Standard Oil Co. (California) quoted a rate of 8 cents per barrel, the Associated Oil Co. a rate of 15 cents per barrel, and the Union Oil Co. of California a rate of 10 cents per barrel for the lines named above.

The information available regarding pipe-line operating cost is not complete nor comprehensive and has not been verified or revised by the Commission.

Section 7. Investment and earnings.

The pipe-line investment, operating expenses, and earnings of the five large companies controlling the major portion of the pipe lines in California were not reported in sufficient detail to enable the Commission to eliminate such items as investment and earnings from outside sources from the reported totals, and thus show the exact earnings for the pipe-line business. The net pipe-line investment, including

working capital, and the earnings as reported by the companies, and the rate of earnings based on the investment at the end of the year for the first year, and on the mean investment, which is obtained by taking one-half of the sum of the investment at the beginning and end of the year for the later years, is shown in the following table:

TABLE 69.—*Net investment, earnings, and rate of earnings in pipe-line business of five large companies, 1914–June 30, 1919.*

Company and year.	Net investment.	Earnings.	Annual rate of earnings.
Standard Oil Co. (California):			*Per cent.*
1914	$13,635,461.19	$3,441,661.74	25.2
1915	12,398,793.02	4,066,937.63	32.8
1916	10,905,875.50	6,362,935.54	58.3
1917	10,794,848.26	7,645,924.12	70.8
1918	10,863,146.72	2,834,740.03	26.1
1919[1]	10,759,332.51	1,217,171.73	22.6
Average			40.0
Associated Oil Co.:			
1914	6,662,994.34	2,073,758.85	31.1
1915	6,528,976.22	2,723,902.47	41.7
1916	6,528,379.43	2,532,524.92	38.8
1917	6,780,553.00	1,915,271.24	28.2
1918	6,861,856.71	1,059,685.56	15.4
1919[1]	6,671,793.83	404,645.40	12.1
Average			29.2
Union Oil Co. of California:			
1915	1,822,982.26	202,199.24	11.1
1916	1,443,718.58	272,681.08	18.8
1917	4,270,804.33	81,704.44	1.9
1918	7,135,149.71	687,267.95	9.6
1919[1]	6,686,369.55	377,923.64	11.3
Average			9.0
General Petroleum Corporation:[2]			
1916[1]	6,864,203.64	638,963.34	18.6
1917	7,112,554.27	1,058,445.75	14.9
1918	7,157,715.38	[3] 58,239.21	[3] .8
1919[1]	6,722,611.08	[3] 229,074.13	[3] 6.8
Average			6.7
Shell Co. of California:			
1918	2,308,228.73	694,485.31	30.1
1919[1]	2,231,279.41	400,633.92	35.9
Average			32.0

[1] Earnings for first 6 months.
[2] Owns General Pipe Line Co. of California.
[3] Loss.

The net investment for most of the companies shows a decline throughout the period which is due to the fact that the depreciation charged each year is generally in excess of new investment. This decrease is particularly pronounced in the case of the Standard Oil Co. (California), whose net investment was $13,635,461.19 at the end of 1914, while net investment for 1919 was only $10,759,332.51.

The investment of the Union Oil Co. of California for the years 1917–1919 includes the Producers' Transportation Co., which is not reported for the preceding years, while during 1915–1917 the Valley Pipe Line Co. operated the pipe line now owned by the Shell Co. of California. The General Petroleum Corporation has no pipe line, but controls the General Pipe Line Co. of California, which owns and operates the pipe line listed under the parent company. The total

investment for this company has been decreased by the elimination of $6,000,000 for good will.

The gross income from the operation of pipe lines depends upon the quantity transported through the lines and the rate per barrel which is allowed for this service. A pipe line should be operated continuously and up to its capacity in order to obtain maximum efficiency. Adequate information regarding the total quantity transported by the pipe lines in California, commonly known as "pipe-line runs," is not available. The pipe-line rates have been discussed in the preceding section of this chapter. The income, as shown for the several companies, is taken directly from the reports of the company with certain revisions for the Standard Oil Co. (California) and the General Pipe Line Co. of California. In the former case the profit or loss on oil delivered to the refineries, as shown in the oil account, is added to or deducted from income, as the case may be, for each year, while for the General Pipe Line Co. of California the charge for interest on bonds has been added back to the income.

The earnings for the Standard Oil Co. (California) doubtless contains some income from sources other than transportation, particularly for the years 1916 and 1917, although some deduction has been made to eliminate any profit on crude petroleum held in storage. The average earnings of the Union Oil Co. of California were low, except in 1916, when there was a marked decrease in the total investment. The Shell Co. of California shows a high rate of earnings for 1918 and 1919, the only years for which information is available. These large earnings were partly due to the fact that the rate per barrel was increased in February, 1918, to 25 cents, while the rate had been 15 cents during 1915–1917. The General Pipe Line Co. of California reports moderate earnings for 1916 and 1917 and losses for 1918 and 1919. The quantity of oil transported was low in the latter years, because numerous exchanges and purchases of crude petroleum for refining purposes have obviated the continuous use of this particular pipe line. Generally, it may be said that pipe-line earnings have tended to decline during the period 1914–1919, which is due to the fact that the rates, except in one case, have remained constant throughout the period, while the operating costs increased in conformity with the upward movement in wages and in the prices of materials and supplies.

The rates of earnings shown on the net pipe-line investment were generally higher than those for other departments, as, for example, refining and marketing. (See p. 199.) The net investment shown above includes the fixed investment and working capital less depreciation, and presumably includes the investment in both trunk and gathering lines. There is a comparatively small increase in the investment for the different companies from year to year, due to the fact that there was no considerable extension of the trunk lines during the period. The largest single pipe line constructed from 1914–1919 was that by the Valley Pipe Line Co., which was later taken over by the Shell Co. of California. The fixed investment in this line amounted to about $3,200,000. As already pointed out, the pipe-line facilities from the different fields have been more than sufficient to transport all the crude petroleum produced each year for the period covered.

The gross fixed investment—that is, the investment before depreciation was deducted—for the companies listed in the foregoing table was $44,543,000 in 1919. At the end of 1919, however, the investment for the Associated Oil Co. represented only 50 per cent of that for the Associated Pipe Line Co., as the Southern Pacific Co. owns half of the latter company. If the total investment for the Associated Pipe Line Co. is included the gross fixed investment in pipe lines for the five large interests, including both trunk and gathering lines, and probably some storage in excess of pipe-line requirements, would amount to approximately $50,000,000.

CHAPTER VIII.

REFINERY COSTS AND REFINERY AND MARKETING INVESTMENTS AND EARNINGS.

Section 1. The refining industry.

DEVELOPMENT OF REFINING.—One of the first attempts to refine California crude petroleum was in 1856 when "some effort was made to refine oil at Brea Ranch." [1] There was little development until 1875, which is said to be the date of the first commercial production of petroleum in California, when a small refinery was constructed at Lyons Station, near Newhall, consisting of two stills or "retorts," with a combined capacity of 75 barrels of crude petroleum; the crude in barrels was hauled by wagons a distance of 9 miles from the wells to this refinery.

The Pacific Coast Oil Co., which was organized and became identified with the California oil business in 1879, completed what was then a "modern refinery," at Alameda, across the bay from San Francisco, with a refining capacity of 600 barrels per day. A pipe line was laid from the wells in Pico Canyon to Newhall, and from that point the crude petroleum was transported to Alameda in tank cars. This was the first transportation of California crude petroleum in bulk by pipe line and tank cars.[2]

Little progress was made in developing the petroleum refining industry prior to 1895. It had been difficult to refine kerosene from California crude petroleum, which could be used satisfactorily for illuminating purposes, and as at that time the principal demand was for illuminating oils, there was little incentive to build additional refining plants. About 1890 the Pacific Coast Oil Co. entered into an arrangement to sell its refined products to the Standard Oil Co. This latter company was a marketing company and utilized the California product by mixing it with kerosene refined in the East and put it on the market as a "safe, reliable oil with proper burning qualities."[3] Later a method of treating California crude petroleum was discovered and a satisfactory kerosene was secured without blending with that produced in the East.

In 1895 the Union Oil Co. of California erected and began operating its refinery at Oleum on San Francisco Bay. The following year, 1896, the Puente Oil Co. constructed its plant at Chino, and in 1899 a refinery was constructed at Gaviota, which was later, in 1906, acquired by the Associated Oil Co. The Associated Oil Co. was thus the third of the present five large refining companies to begin operation in California. These plants are still being operated.

In 1900 the Standard Oil Co. (New Jersey) acquired the stock of the Pacific Coast Oil Co. and since that time petroleum refining in California has been developed on a large scale. Prior to 1900 only

[1] California State Mining Bureau, Bull. 69, p. 308.
[2] Standard Oil Bulletin, May, 1913, p. 10.
[3] Ibid.

gasoline, refined oil (kerosene), a few grades of lubricating oils, and asphalt had been manufactured from California crude, and the products were only sold locally and at points easily reached by the transportation facilities.[4]

As already stated, the rapid development in refining began about 1900, and by 1904 more than a score of small refineries had been constructed. It was during this period that the Pacific Coast Oil Co. dismantled its small refinery at Alameda and erected a large refinery at Richmond on San Francisco Bay. The Richmond plant was then, and it is to-day, the largest refinery on the Pacific coast, and is one of the largest in the United States. In 1904 it consumed 3,317,000 barrels, or about 80 per cent of all the crude petroleum refined by by all the refineries in California, notwithstanding the fact that there were 32 companies operating 34 refineries in the State.

The General Petroleum Co., the predecessor of the General Petroleum Corporation, erected a large topping plant at Vernon, near Los Angeles, in 1912, and the Shell Co. of California began operating its large lubricating plant at Martinez on San Francisco Bay, and a topping plant at Coalinga in 1916. These two companies were the last of the present five large refining companies to begin refining activities in California.

There was steady progress in the development of the petroleum refining industry in California from 1910 to 1920. Among the larger refining plants built during this period were those constructed by the Union Oil Co. of California. In 1910 this company built a 17,000-barrel plant at Avila, in 1911 a 10,000-barrel plant at Brea, and in 1919 a 12,000-barrel plant at San Pedro. While many small plants have been built only to be operated a short time and then abandoned, each year has seen a material increase in the total refining capacity of the State. The total crude petroleum treated in the refineries in California increased from a little over 4,000,000 barrels in 1904 to over 72,000,000 barrels in 1919, which represents an increase of 1,700 per cent, while during the same period the crude petroleum production of the State increased from 29,500,000 to 101,200,000 barrels, or 243 per cent.

The construction of extensive pipe lines and the utilization of tank steamers for the transportation of crude petroleum has enabled large refining companies in California to follow the practice, which had been proven most economical in other parts of the country, of locating their large refining plants near the large consuming centers which afford the best transportation facilities from which to distribute their refined products. The fundamental factor which decides the location of a petroleum refinery is the relation between the cost of transportation of crude petroleum and that of the refined products. Crude petroleum is mainly transported by pipe lines, while refined products are largely transported by rail and water carriers, and as the cost of transportation by pipe line is very much less than the cost of transportation by rail, the ideal location for a refinery is near a large consuming center which is supplied with adequate rail and water transportation facilities for use in the distribution of refined products. There are two such locations in California—on San Francisco Bay and in the neighborhood of Los Angeles. There are seven refining plants

[4] Standard Oil Bulletin, June, 1913.

in California with a rated daily capacity of over 20,000 barrels each, four of which are located on San Francisco Bay, two in the vicinity of Los Angeles, and only one near the inland oil fields. This latter refinery is located near Bakersfield, and a very large percentage of its distillates are transported in an unfinished state, by pipe line, to Richmond on San Francisco Bay, where the refining process is completed. Refineries in California which are located near the oil fields have difficulty in securing an adequate water supply, are far from the labor markets of the State, and have only a limited local market for their refined products.

REFINERIES IN CALIFORNIA.—During 1919 there were 26 companies engaged in refining crude petroleum in California. These 26 companies operated 38 refining plants, which represented a gross investment of about $50,000,000. Their rated daily refining capacity was almost 308,000 barrels, or about 112,000,000 barrels per year. Their capacity was about 11,000,000 barrels greater than the 1919 production and over 6,000,000 greater than that for 1920. As a considerable proportion of the California crude petroleum production is a heavy crude that is mostly sold for consumption as fuel without refining, this capacity is much greater than can be supplied by the present crude production. In 1919 about 72,618,000 barrels were refined, or 65 per cent of the rated capacity.

The five large refining companies operate 15 refineries, representing a gross plant investment of nearly $47,000,000, or 94 per cent of the total. Their rated daily capacity was 274,300 barrels, or about 89 per cent of the total. The plants of the five companies consumed over 66,000,000 barrels of crude petroleum during 1919, which was 91 per cent of the total for the entire refining industry in California.

The location, date constructed, gross value of plant investment January 1, 1920, the rated daily capacity, the quantity of crude petroleum refined in 1919, and the principal refined products produced by each are shown in Appendix Table 46.

PRINCIPAL PROCESSES.—A brief nontechnical description of the principal refining processes and methods in use in California is desirable in order to clearly present the different phases of this branch of the petroleum industry of that State. In general, petroleum refining consists of heating the crude petroleum until it is vaporized and then condensing the vapor. This operation is termed distillation and it breaks up the crude petroleum into fractions of different gravities, densities, and degrees of inflammability. The lighter and more volatile fractions vaporize first, and as the distilling process is continued the distillates constantly become heavier and less volatile, until a nonvolatile residuum remains in the still. Each fraction that has been vaporized and condensed consists of a mixture of dissimilar portions and the cut or division point between any two products is more or less arbitrary. A change in this division point affects both the quantity and quality of a given product, and the refiner is enabled to vary the yield of some products within certain limits in response to supply and demand conditions.

Straight-run process.—The straight-run still, although rarely used at the present time, clearly illustrates the principles involved in the process of distillation. The crude petroleum is charged into the still by means of a pipe passing through the top of the still, and continuing down near the bottom to avoid splashing and evaporation

while charging, and also to allow the crude to be pumped back to storage if it is desired to empty the still before it has been heated. As soon as the still is filled the charging line is closed and the fire is started. When the temperature of the crude is brought to the proper point the light fractions begin to vaporize and pass through the vapor line to the condenser. Here the vapor is cooled and condensed. The condensate collects and passes through a pipe, called the tail pipe, into the receiving house. The tail pipe ends in a box, called the "look box," with glass sides, so that the size and character of the stream can be seen. Tests are taken of the distillate at the look box so that the stream can be diverted into the proper receiving tank. It is here that the "cuts" are made in the distillate. The first product is usually light crude naphtha, the second heavy crude naphtha—then generally two grades of kerosene distillate, and next gas oil. The last cut is usually the lubricating distillate, and when this distillate has been obtained the fires are drawn, the residuum is drawn off, and the still is allowed to cool and is then prepared for another run.

Continuous crude stills.—By constructing a battery of stills properly connected with each other, the process of distillation is made continuous. In this process the crude petroleum is constantly fed into the first still, which is maintained at a constant temperature sufficient to vaporize the light naphtha distillate. A continuous stream of this distillate is obtained from this still. The residue from this still constantly passes on into the second still, which is maintained at a higher temperature sufficient to vaporize the heavy crude naphtha. A continuous flow of this distillate is thus secured from the second still. The residue passes on to the next still, and so on to each succeeding still. As the residue passes from one still to another it encounters constantly higher temperatures, which are sufficient in each case to vaporize a heavier distillate. From the last still of the battery the residuum goes into a receiving tank. The vapors from each still are conducted into separate condensers, from which distillates pass through the tail pipe into the look boxes and thence into separate tanks. The same principles of the straight-run process apply in the continuous crude stills without the loss of time involved in emptying the still, cooling it off, refilling it with crude petroleum. and then heating it again.

Rerun stills.—The distillates from the crude stills, often called the products of the first distillation, are in an unfinished state and require further distillation and treatment to produce the finished products. Rerun stills are similar to crude stills and are reserved for rerunning certain distillates. Naphtha distillate, however, is not rerun in such stills, but in steam stills, as described later.

Heavy kerosene distillate, called in some sections "standard white" distillate, is rerun, producing crude naphtha, light kerosene distillate, heavy kerosene distillate (which is again rerun), and fuel oil. The crude naphtha goes into stock with crude naphtha from other sources. The light kerosene distillate is ready for treatment in the agitators.

Lubricating plants have lubricating stills, which are simply rerun stills equipped for rerunning lubricating distillate, producing various grades of lubricating stocks, which through filtering and other

processes and compounding or mixing, with animal and vegetable oils, produce the innumerable grades of lubricating oils.

Agitators.—All refineries producing finished gasoline and kerosene are equipped with agitators. An agitator is a cylindrical tank equipped for treating crude naphtha and light kerosene distillates with chemicals, such as sulphuric acid, to remove impurities and coloring matter. The distillate to be treated is run into the agitator, the acid is sprayed on top, and an air blast is inserted in the bottom of the tank, which sets the distillate in motion. The "rolling and tumbling" motion thoroughly mixes the acid with the distillate. After settling, the "acid sludge" is drawn off from the bottom of the tank. The distillate is then washed with water and treated with an alkali, such as caustic soda, to neutralize all traces of the acid, when it is again washed to free it from the alkali.

Steam stills.—After receiving treatment in the agitators the naphtha distillate is ready for its final process, that of finishing in the steam stills. In this process the treated naphtha distillate comes in direct contact with live steam, which is distributed from perforated pipes running along the bottom, the full length of the still, so as to distribute the steam evenly and directly into the naphtha distillate. This is the final process in the production of gasoline and naphtha. From crude naphtha treated in the steam stills all desired grades of finished gasoline and naphtha are secured and the residue, "naphtha bottoms," is considered the same as heavy kerosene distillate.

Cracking processes.—During recent years there has been a large increase in the use of different cracking processes by refiners throughout the United States; but in California only two refiners have installed such plants. The cracking process is used to obtain larger yields of such products as gasoline and kerosene than can be secured by ordinary methods of distillation. This process does not operate upon crude petroleum but redistills heavy distillates such as gas oil and fuel oil. In the cracking process these distillates are subjected to extremely high temperatures under very heavy pressure in specially constructed stills called pressure stills. The high temperature and heavy pressure cause the molecules of gas and fuel oil to break up and the atoms to rearrange themselves and produce an additional yield of lighter gravity distillates, such as crude naphtha and kerosene distillate. The crude naphtha and kerosene distillates are then treated and finished in the same manner as such products produced by ordinary methods of distillation. The process of cracking and rerunning is practical when the price of gas oil and fuel oil are comparatively low and it is desired to get a high yield of gasoline. It is not practiced extensively in California where fuel oil finds a ready market at comparatively good prices.

Section 2. Yields from California crude petroleum.

CHARACTER OF CALIFORNIA CRUDE.—Practically all of the crude petroleum produced in California is an asphaltic base crude and yields a comparatively small percentage of the lighter products such as gasoline and naphtha. The great bulk of California crude ranges from 8° to 40° Baumé, and its character largely determines the use that is made of it; for example, the heaviest crude, ranging from 8° to 14° Baumé, is best adapted to the production of asphalt, and the

asphalt plants generally operate on this grade of crude; the crude ranging from 14° to 17.9° Baumé, which is designated commercially as "crude fuel oil," or heavy crude, is largely used for fuel oil in its crude state or is mixed with refinery residuum and marketed as fuel oil, while the lighter crude petroleum beginning with that 18° Baumé is termed light crude, and is used by petroleum refineries for the production of refined products. Recently, on account of the great demand for gasoline and lubricants, heavier grades are being refined. In this connection the Standard Oil Co. (California) defines its policy as follows:

> Through its processes, the company finds something of value in all California crude oil. There is a practice in California of selling lower grade oils for fuel, without the crude being put through a refining process. This this company does not do, and even the heaviest grades of crude oil are passed through the refinery. It is a fixed policy of the company that it markets no crude oil even for fuel purposes.

PRINCIPAL REFINED PRODUCTS.—There are a large number of products obtained from a barrel of crude petroleum by California refineries; these products vary from solid coke to the highly volatile aviation gasoline, which ranges from 72° to 75° Baumé. The principal products are as follows:

	° Baumé.		° Baumé.
Aviation gasoline	72 –75	Gas oil or Diesel oil	27–29
Motor gasoline	54 –58	Lubricating oils	20–28
Engine distillate	44 –47½	Residuum	15–20
Kerosene domestic	42 –43½	Road oil	10–12
Kerosene export	40 –40½	Asphalt	Semisolid.
Stove distillate	33½–35	Coke	Solid.

Stove distillate is simply an untreated kerosene.

There are several hundred grades of lubricating oils and their quality is determined by the degree of refining and the formulas of compounding rather than by the Baumé test. There are also a number of grades of asphalt. In California the coke is used by the refiners for fuel in connection with their refinery operations.

A small quantity of crude petroleum, which has a paraffin base, is produced in the Ventura County Field, from which two companies—the Standard Oil Co. (California) at El Segundo and the Ventura Refining Co. at Fillmore—secure a small percentage of paraffin wax.

The early refineries operated primarily for kerosene, with naphtha or gasoline as a secondary product. With the development of the internal combustion engine, the refiners shifted from kerosene as a main product to gasoline. Improvement in internal combustion engines which permit the use of gasoline of a lower Baumé test, together with improvements in refining processes, have greatly increased the yield of gasoline from the California crude. This has been done at the expense of heavier products. The construction of internal combustion engines consuming a product known as "engine distillate," containing both gasoline and kerosene, has curtailed the kerosene output. For comparative purposes gasoline and engine distillate may be combined, as both products are consumed in internal combustion engines. In fact a profitable study of the yield statements may be made by combining the yield of gasoline, engine distillate, and kerosene. These are the principal products affected by the policy of manipulating the runs so as to obtain higher yields of products which are more in demand and higher in price. Since at the present time these products are the

higher priced, refiners as a rule endeavor to obtain the maximum yield of these three combined. The yield statements reveal the fact that as the percentage of gasoline obtained from crude petroleum increases there is a corresponding decrease in the yield of kerosene and heavier products, and as the quantity of lubricants is increased there is a further reduction in the percentage of fuel oil produced.

During the last few years there has been a marked increase in the quantity of lubricating oil refined from California crude petroleum. The demand for lubricating oils has been greatly increased by the development in the use of internal combustion engines, and this has led some of the California refiners to equip their plants for the production of lubricating oils. As a result, lubricating distillate, which formerly remained in residuum and was marketed as fuel oil, is now cut off separately and run through the lubricating stills, where it is further refined and blended with certain animal and vegetable oils and ultimately yields several hundred grades and brands of lubricants. California lubricants are advertised as "strictly asphalt base oils" and are guaranteed to contain no paraffin. It is claimed that they stand the cold test better than paraffin base lubricants.

The "residuum" or residue from the refining process is considered more important in California than in the other sections of the United States, mainly because the demand for fuel oil is more regular and the price relatively higher on the Pacific coast than in other sections of the country. This higher price is due to the less effective competition of other fuels on the Pacific coast. As the fuel oil obtained from the refining process consists of the residuum left after taking off the lighter products, any increase in the yield of refined products is accompanied by a corresponding decrease in the percentage of fuel oil produced, and furthermore, an increasing percentage of the total crude petroleum produced in California is run through refineries each succeeding year, thus further decreasing the fuel oil proportion of California crude petroleum.

REFINERY YIELDS.—The United States Bureau of Mines began the collection of detailed statistics of petroleum refinery production and the stocks of refined products for the year 1916, and since that time it has obtained more detailed information regarding refinery operations. The Commission has compiled a table from the refining statistics gathered by the Bureau of Mines, eliminating unfinished distillates rerun, showing the total quantity and percentage of each of the leading products obtained from the crude petroleum refined by all the refineries in California from 1916 to 1920 inclusive. (See Appendix Table 47.) The percentage that the quantity of each products bears to total crude run agrees substantially with the combined yield of products obtained from California crude petroleum by the principal refineries covered in detail in this report. The quantity of crude petroleum refined in California increased from 62,950,127 barrels in 1916 to 76,410,932 barrels in 1920.

The gasoline and naphtha produced increased both in quantity and in percentage from 1916 to 1920. The kerosene production fell off greatly in 1918 due to the fact that the refiners produced as little as possible on account of the strong demand for highly volatile products such as gasoline, while in 1919 and 1920 there was an enormous increase in its production, both in total quantity and in percentage. In these years there was a strong export demand for kerosene.

he quantity of fuel oil obtained after distilling off the lighter products ıcreased from 1916 to 1919, but the percentage obtained from the rude and distillates refined decreased considerably. The quantity nd the percentage of lubricants produced was higher in 1917 than ı any other year. Other products show the largest production in 918, while there was a steady increase in the quantity and percentge of refinery loss throughout the period 1916 to 1920.

The Commission obtained detailed information for the five large ıfining companies operating in California. This information was ıther taken directly from the records of the different companies by ıaminers of the Commission or checked by them with such records. . comparison is shown between the combined production for the ve companies, by products, and the total for all refineries in Cali- ırnia in Appendix Table 48.

The five large refiners have produced from 91.5 to 97.1 per cent of ıe total quantity of gasoline and engine distillate produced in Califorıa from 1916 to 1919, and there was very little variation in the proporon during the period. Their production of kerosene varied from 94.9) 98.3 per cent, while their proportion of fuel and gas oil declined from 7.1 per cent in 1916 to 88 per cent in 1918 and 89.1 per cent in 1919. he percentage of lubricants produced by the five large refiners uctuated greatly from year to year; the highest per cent was in 918, when 95.4 per cent was produced by them, while in 1917 they roduced only 55.8 per cent. The large refiners showed a larger ercentage of other products and refinery loss in 1916 than in any ther year and the lowest percentage in the last two years.

As already pointed out, the percentages of the different products ıcured from the refinery operations for a given year do not neces- ırily indicate that the same percentages would be secured from the ıme quantities of crude petroleum of identical quality during some ther year, as the percentages obtained are influenced to a consider- ıle degree by demand and price considerations. The following ble shows the yields obtained by four of the five large refining ımpanies in California for the first half of 1919; a similar table ppendix Table 49) for the same companies is shown for the years 16–June 30, 1919.

BLE 70.—*Percentage of principal products obtained from California crude petroleum by four large refining companies, first six months, 1919.*

Product.	Company—			
	A	B	C	D
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
oline	14.88	5.06	11.18	10.66
gine distillate	7.31	1.42	2.51	4.85
sene	.53	6.60	12.79	2.38
l oil and gas oil	71.88	79.05	65.90	73.77
ricating oil		2.15	2.97	.47
haltum			1.65	2.21
er products	4.07	3.76	.56	3.25
ning loss	1.33	1.96	2.44	2.41
Total	100.00	100.00	100.00	100.00

Company C shows a much higher percentage of gasoline from 7–June 30, 1919, than for 1916, while if engine distillate, which is

also a motor fuel, be included the increase in the later years is still greater. The percentage of kerosene produced varied greatly from year to year, while the totals for gasoline, engine distillate, and kerosene combined were larger the last two and one-half years than during 1916. The percentage of lubricating oils increased steadily from 1916 to 1918, at which time it was almost twice as great as for the earlier year. The first half of 1919 showed a decline as compared with 1918, but the percentage was higher than for any year prior to 1918. The percentage of fuel oil and gas oil was slightly smaller in 1918 and for the first half of 1919 than for the earlier years. The refinery loss shows an increase from 1.64 per cent in 1916 to 2.44 per cent in 1919.

Company A increased its percentage of gasoline from 7.17 per cent in 1916 to 14.88 per cent for the first half of 1919. This represented slightly more than a twofold gain, while during the same time the proportion of engine distillate produced was greatly increased. The percentage of kerosene produced by this company was very small throughout the entire period. The combined production of gasoline, engine distillate, and kerosene increased steadily throughout the period from 12.43 per cent to 22.72 per cent. The percentage of fuel-oil and gas-oil production decreased steadily after 1916, declining from 79.99 per cent in 1916 to 71.88 per cent for the first six months in 1919. The refinery loss fluctuated considerably from year to year, but for the period it increased from 0.73 per cent in 1916 to 1.33 per cent for the first six months of 1919.

Company D increased its percentage of gasoline production from 11.07 per cent in 1916 to 12.03 per cent in 1918, while during the first six months of 1919 it dropped back to 10.66 per cent. The percentage of engine distillate produced changed very little from year to year. This company's percentage of production of kerosene varied from 1.44 per cent to 2.38. The combined percentage of gasoline, engine distillate, and kerosene produced fluctuated from year to year without showing any marked change. The percentages of fuel oil produced annually fluctuated from year to year without showing any marked tendency toward an increase or decline. The refinery loss varied from 3.39 per cent in 1916 to 2.41 per cent for the first half of 1919.

The refinery yield statements for Company B show that the percentage of the production of gasoline has steadily increased from 3.3 per cent to 5.06 per cent for the first half of 1919, while the proportion of engine distillate produced has declined from 3.41 per cent in 1916 to 1.42 per cent for the first six months of 1919. The production of kerosene has been very erratic, varying from as high as 10.16 per cent in 1916 to only 0.6 per cent in 1918. The production of fuel and gas oil has fluctuated from year to year; 1918 shows the smallest percentage, viz, 72.33 per cent, while the first six months of 1919 show 79.05 per cent, which was the largest percentage for the period. The percentage of refinery loss increased steadily from 1.7 per cent in 1916 to 2.33 per cent in 1918, after which it declined to 1.96 per cent for the first half of 1919.

The percentage of the principal products produced by four of the large refining companies in California, as shown in Appendix Table 49, includes the operations of all of their plants. Some of the plants do not completely refine the crude petroleum; hence the variations in the percentages shown for the different companies are partly due

o the differences in the degree of completeness of the refinery operaions and partly to the difference in the character of the crude petroeum refined.

Probably the nearest approach to the maximum yield of refined roducts which can be obtained from California crude petroleum nder commercial operating conditions is shown by the operations f the large lubricating plants. There are four such plants in Caliornia, which are covered in detail by this report; these include the lants of the Standard Oil Co. (California) at Richmond and El egundo, the Union Oil Co. of California's plant at Oleum, and the lant of the Shell Co. of California at Martinez.

Appendix Table 50 shows the percentage of the principal products btained by these four companies at their most complete refineries or the period 1916–June 30, 1919.

PRODUCTION OF CASING-HEAD GASOLINE.—The total production of asoline and motor spirits in California has been considerably augnented, especially in the last few years, by the production of asing-head gasoline. The term "casing head" has been applied to asoline recovered from natural gas because it is extracted from the as that comes from the casing head of oil wells. Petroleum from the il fields is usually accompanied by more or less gas. As the gas from he casing heads of oil wells is usually "wet," the extraction of the asoline serves a twofold purpose—it dries the gas, making it comnercially useful and conserves the gasoline. A small percentage of asoline is obtained by some companies from very wet gas by conensation, which consists of passing the gas through a coil of cooled ipe, permitting the condensed particles of gasoline to drop into a eceiving tank, Practically all of the casing-head gasoline, however, s extracted in compression or absorption plants. These plants may e operated independently, but often a compression plant is operated n conjunction with an absorption plant. One large company decribed its casing-head operations of the two plants as "one conınuous process." The gas is first treated in the compression plant, here a part of the gasoline is extracted and the gas is prepared for he absorption plant, where the remainder of the gasoline is absorbed nto crude oil or heavy distillate to be distilled out immediately or to emain in the crude oil to be recovered in the regular refining process. fter the gasoline is extracted the dry gas is taken into the gas pipe nes to be consumed by the company in operating its producing roperties. The surplus dry gas, if any, above the company's own equirements is sold to gas distributors or consumers.

Some concerns market casing-head gasoline separately, either raw blended with low-grade naphtha or kerosene distillate into blended asoline, while others turn it into the oil pipe lines, thus mixing this ry light gasoline with the crude petroleum for transportation to the finery, where it is later recovered in the form of gasoline through the gular refining process.

Table 71 shows the number of operators and plants, the estimated quantity of gas consumed, and the quantity of casing-head gasoline produced in California from 1912 to 1919:

TABLE 71.—*Casing-head gasoline production in California, 1912–1919.*

Year.	Number of operators.	Number of plants.	Estimated volume of gas used.	Casing-head gasoline produced.
			Cubic feet.	*Gallons.*
1912 [1]	7	7	600,743,000	1,040,695
1913 [1]	12	14	2,436,445,000	3,460,747
1914 [1]	17	19	5,129,709,000	7,581,309
1915 [1]	18	20	8,006,888,000	12,835,126
1916 [1]	28	36	24,826,354,000	17,158,754
1917 [1]	45	49	45,351,247,000	28,817,604
1918 [1]	29	56	50,490,019,000	32,268,933
1919 [2]	29	[3] 50	.....	38,034,256

[1] Bulletin No. 176, U. S. Bureau of Mines, 1919.
[2] California State Mining Bureau, Summary of Operations, California Oil Fields, June, 1920.
[3] Approximate.

The growth in the number of operators, the number of casing-head plants, and the quantity produced has increased greatly since 1912. The production of casing-head gasoline in 1919 was over thirty-six times as great as in 1912. In 1916, the first year for which the Bureau of Mines compiled refinery statistics, the casing-head gasoline production for California was 4.1 per cent of the gasoline production of petroleum refineries in that State. The following year it increased to 6.6 per cent; in 1918 it was 8.3 per cent, while in 1919 it equaled 12.3 per cent of the refinery production.

Section 3. Cost of refining.

COMPANIES DISCUSSED.—Detailed data covering the refining operations of the five large refining interests in California were obtained from the books of the companies. This cost information was all obtained or verified by the Commission's examiners. Reports were obtained for the Associated Oil Co. and the Standard Oil Co. (California) for the period 1914–June 30, 1919, while similar information was secured from the Union Oil Co. of California beginning with 1915, and from the Shell Co. of California and the General Petroleum Corporation beginning with July 1, 1916, down to June 30, 1919.

CONSUMPTION OF CRUDE PETROLEUM.—The five large refiners named above refine most of the crude petroleum consumed by the refining industry of California. The following table shows the total quantity of crude petroleum refined in California, as reported by the United States Bureau of Mines, the quantity and percentage of that total consumed by each of the five large refiners and the combined quantity and percentage of the total refined for all five companies, 1916–June 30, 1919:

TABLE 72.—*Petroleum refined and proportion consumed by five large companies, 1916–June 30, 1919.*

Company.	1916		1917		1918		1919 [3]	
	Barrels.	*Per ct.*	*Barrels.*	*Per ct.*	*Barrels.*	*Per ct.*	*Barrels.*	*Per ct.*
Standard Oil Co. (California)	31,351,225	49.8	34,728,421	47.6	30,467,652	45.8	16,795,075	47.6
Union Oil Co. of California	9,378,596	14.9	9,670,421	13.2	10,924,546	16.4	5,834,002	16.5
Associated Oil Co	7,928,189	12.6	7,967,437	10.9	7,023,567	10.6	3,247,468	9.2
General Petroleum Corporation	[1] 2,934,877	[1] 4.7	6,698,191	9.2	5,815,527	8.8	2,872,812	8.1
Shell Co. of California	5,239,643	8.3	6,680,717	9.2	6,781,969	10.2	3,561,466	10.1
Total	56,832,530	90.3	65,745,187	90.1	61,013,261	91.8	32,310,823	91.5
Total, California [2]	62,950,127	100.0	72,949,725	100.0	66,464,969	100.0	35,315,898	100.0

[1] Last 6 months. [2] U. S. Bureau of Mines. [3] First 6 months.

The General Petroleum Corporation began operations in July, 1916; this accounts for its small percentage of the total refined in that year. The Standard Oil Co. (California), the Associated Oil Co., and the General Petroleum Corporation, show a smaller proportion of the total consumed during the first six months of 1919 than for the earliest full year's operations, while the Union Oil Co. of California and the Shell Co. of California show a larger percentage for the latter year. The combined refinery totals for the five large refiners show that they consumed about 90 per cent of the total for the State during 1916 and 1917, almost 92 per cent in 1918, and 91.5 per cent during the first half of 1919.

PROBLEMS INVOLVED IN COMPUTING THE COSTS.—There are three problems in connection with determining the cost of refining crude petroleum that involve an arbitrary decision, viz, (1) the cost at which crude petroleum is charged to the refinery for the highly integrated companies, (2) the amount of depreciation allowed, and (3) the method of allocating costs to the different products. In showing the cost of refining a barrel of crude oil only the first two problems are involved, while all three affect the result when costs for different products are shown.

Cost of crude.—The cost of the crude petroleum consumed is the largest element in the cost of a barrel of refined petroleum, and this element of cost becomes more important when its price is high. Each of the five companies for which refining costs are shown produces a large percentage of the crude petroleum consumed by its refineries and purchases the remainder at current market prices. There are two methods of computing the cost of the crude petroleum for refining companies producing part of their consumption, viz, (1) at the actual cost of the crude purchased or produced plus the actual cost of transporting it from the oil fields to the refinery, and (2) at the current market price plus transportation charges at the published tariff rates. The first method shows the true cost to the company of refining a barrel of crude petroleum.

The second method, as already stated, is to charge the crude to the refinery at the current market price of crude petroleum at the wells plus the published tariff rate of transportation. This method though not strictly cost to the company as a whole, puts refiners purchasing all or a large percentage of the crude refined by their refineries on the same basis, for comparative purposes, with refiners producing all or a large percentage of their refinery requirements.

The relative proportions of refinery requirements of crude petroleum produced and purchased vary with the different refiners and for different periods. Under this method of treating crude petroleum cost any profits or losses resulting from charging it to the refinery at the current market price plus transportation at tariff rates are reflected in the operations of the producing and pipe-line departments. There is another element of profit or loss resulting from the application of this method. Crude petroleum is produced or purchased and put in storage and the price frequently changes before it is drawn out to meet refinery requirements. Such profits or losses accrue to the department holding the storage, which for most companies is the pipe-line department. This method makes it practicable to compare the departmental activities of the integrated companies with the operations of smaller companies.

Depreciation.—The depreciation item is an important one and there was no uniform rate used by the different companies. The figures set up by the refining companies to take care of depreciation of their plants varied from 7½ per cent on the net book value of the plant to 5 and 10 per cent on the gross plant investment. This variation in so important an item in the cost of refined products made it desirable to set up an arbitrary figure and apply it uniformly to all plants. The following table shows the value of the total gross plant and equipment (excluding land), the amount of depreciation charged by the companies representing all refineries operated by the five large refining interests in California, and the average rate of depreciation from December 31, 1914, to June 30, 1919:

TABLE 73.—*Refinery investment, depreciation, and rate of depreciation for five large refining companies, 1914–June 30, 1919.*

Year.	Gross refinery investment.	Depreciation charged by companies.	Rate per annum.
			Per cent.
1914	$16,477,185.81	$607,933.44	3.9
1915	21,364,479.88	820,207.07	3.8
1916	27,246,406.26	1,142,382.05	4.2
1917	30,786,275.13	1,404,747.86	4.6
1918	35,208,954.56	1,690,218.55	4.8
1919 [1]	37,299,222.08	899,656.64	4.9

[1] June 30.

In order to determine a depreciation figure which would take care of the actual depreciation of the refinery investment, it would be necessary to depreciate each item of the equipment separately, such as buildings, stills, condensers, agitators, boilers, engines, tanks, pipe, fittings, machine shop, and loading racks. This would require a complete analysis of each refinery and a determination of the probable life of each class of equipment. Such a minute revision of depreciation is not practicable in an investigation of this character, and the Commission has adopted an arbitrary rate of 5 per cent per annum on the gross plant investment excluding land. While this rate is lower than that set up by some of the refiners, it is slightly higher than the average rate actually charged by all the companies.

It is believed to be an ample provision for the depreciation of well-constructed refining plants which are assured of an adequate supply of crude petroleum for a long period of time.

Cost of specific products.—There is no method by which an entirely satisfactory unit cost can be computed for each of the numerous products that are obtained from a barrel of crude petroleum. The difficulty in computing a fairly satisfactory cost for each product is chiefly due to two facts: (1) Because it is difficult to assign to each product its just proportion of the cost of the raw material—crude petroleum—which is the largest single item of cost; and (2) because the refining processes are continuous and there is an interrelation between these processes and between the products secured therefrom.

Several methods of showing a cost for different petroleum products have been used, as for example: (1) By application of the average cost per gallon for all products to each particular product produced; (2) by determination of a specific cost for each product by charging each with its proportion, based on the quantities produced, of the cost of crude petroleum and general expenses, to which is added the proportion of the actual cost of the refinery operations required for the production of each particular product; (3) by making use of a by-product cost method to obtain the cost of the main product, as gasoline, all other products being treated as by-products. By this method the total cost of all products is first obtained and then the total net receipts from by-products are deducted therefrom. The resulting cost is the total cost of the main product. The cost per gallon is then readily obtained by applying the gallons produced; (4) by allocating costs to the particular products on the basis of sales value.

Each one of the methods outlined above is open to some criticism. The first method which applies the average cost of all products to each product is unsatisfactory because it shows a very large margin of profit on the high-priced products, while a loss is usually shown on those products sold at a low price per gallon. The cost obtained by the second method is also unsatisfactory because it gives the lowest cost for gasoline, while the highest cost is shown for residuum, which is usually sold at a low price. The by-product method shows a very low cost for the products selected as main products. The last method, which allocates cost on the basis of sales value, charges to the higher priced products a larger proportion of the cost of the raw material and other expenses than are charged to the lower priced products. This method, like the other three, is open to criticism. Whenever the price of one product increases or declines out of proportion to the price changes for other products, the cost of a particular product may by this method show an increase due to a change in prices, even though the general cost level has declined. This is due to the fact that the factors which affect cost differ from those influencing price.

While it is not possible to devise a method that is entirely satisfactory, it is desirable to select the method which is least objectionable and that is considered fairly accurate by experienced petroleum refiners. In 1917 conferences were held with representatives of the petroleum refining industry, and the fourth method enumerated above, that of allocating costs to the different products on the basis of sales value, was adopted. The costs at that time were being obtained with a view

to considering what prices would be reasonable for the several products. It was recognized by the Commission and by the representatives of the petroleum refining industry that any method of determining the cost of the several petroleum products is arbitrary, but it was generally agreed that this method was superior to any other for this purpose. This is the method used in this report.

COMPANIES' COSTS NOT COMPARABLE.—As already stated, the Commission obtained data covering the cost of refinery operations for the five largest refining companies operating in California. This information was secured from their records or checked with them by examiners of the Commission. Such costs were obtained for the Associated Oil Co. and the Standard Oil Co. (California) from 1914 to June 30, 1919; for the Union Oil Co. of California from 1915 to June 30, 1919; for the Shell Co. from the beginning of 1916 to June 30, 1919; and for the General Petroleum Corporation from July 1, 1916, to June 30, 1919.

The refining costs obtained from the different companies are not strictly comparable because the companies do not have a uniform policy as to the price at which the crude petroleum which they produce is charged to the refinery. The Standard Oil Co. (California), the Union Oil Co. of California, and the Associated Oil Co. charged the crude petroleum they produced to their refineries at the posted market price at the wells plus transportation charges at tariff rates. This policy gives the producing and pipe-line departments the same profit they would obtain for sales to or transportation service for outside concerns. Moreover, the rates for depreciation charged by the several companies are not the same. The Standard Oil Co. (California) charges 7½ per cent for depreciation on the net investment, which for the period covered was equivalent to less than 4 per cent on the gross investment, while the other three companies charge 5 or 10 per cent on the gross investment.

REVISION OF COSTS.—The Commission has revised the costs of refinery operations, as shown by the books of the companies, in two particulars, first, a uniform rate for depreciation of 5 per cent on the gross refinery investment as shown by the books of the companies has been used instead of the amounts charged by the companies (see p. 180), and second, the cost of the crude petroleum refined which was produced by each company has been charged at the cost of production plus the cost of transportation instead of the current market price plus transportation at tariff rates. The revision of depreciation places the companies on a uniform basis in this respect, while charging the crude petroleum at cost of production plus cost of transportation eliminates interdepartmental profits.

The Commission's revision of depreciation to 5 per cent per annum on the gross plant investment decreased this charge for all of the companies excepting for the Standard Oil Co. (California). The crude petroleum purchased by each company has been charged at the purchase price plus cost of transportation. This revision of the cost of the crude petroleum has resulted in a material reduction in the cost of this item for each company.

Appendix Table 51 shows the total quantity of crude and purchased oils run, the cost to the companies delivered at the refinery, the refinery operating expense, general and administrative expense, and depreciation for all companies combined for 1914 to June 30,

1919. This table shows the cost as determined by the Commission, the cost as reflected on the books of the companies, and the difference between the two.

During 1916, the first year all five companies operated, they consumed 57,583,323 barrels of oil, at a cost delivered to the refineries of $33,787,265, while in 1918 the same companies consumed 62,245,140 barrels of oil, which cost the companies delivered $55,486,977. The cost above materials, including general and administrative expenses and depreciation, amounted to $8,731,951 in 1916 and $16,580,711 in 1918. For the first six months of 1919 these companies consumed 32,850,104 barrels of oil at a delivered cost of $30,626,274. The total operating expense was $10,741,293.

COST PER BARREL.—The most satisfactory unit on which to compute the cost of a product ordinarily is the sales unit. However, there is no uniform sales unit for the products obtained from a petroleum refinery, and the barrel of 42 gallons has been selected as the best unit on which to compute refinery costs. This unit is used in the purchase and sale of crude petroleum and for transactions in such refinery products as fuel oil and road oil; while such products as gasoline and kerosene are sold by the gallon, paraffin wax is sold by the pound, and asphalt is sold by the ton. It is evident that there is no uniform sales unit for refinery products, while there is a uniform unit used for transactions in crude oil, which unit also finds considerable use in commerce in refined products. A barrel of 42 gallons of crude oil is run through a refinery and several products, each of a different commercial value, are obtained in the process. Some of the products can be sold for several times the cost of an equal quantity of crude oil, while others are sold for no more and some for even less than the cost of an equal quantity of the raw material. A barrel of oil is refined and only about 41 gallons of finished products are recovered, the remainder being designated as refinery loss. The cost of the 42-gallon barrel of crude, as well as the total operating cost per barrel, must be absorbed by the receipts from the sale of the finished products recovered.

The cost delivered at the refinery of oils consumed, the cost above raw materials, and the total refining cost per 42-gallon barrel of oil run for each of the five large companies, and the total for all companies combined annually, 1914 to June 30, 1919, is shown in the following table:

TABLE 74.—*Refining cost of five large companies, per barrel of 42 gallons, 1914–June 30, 1919.*

Year.	Company A.			Company B.			Company C.		
	Crude oil cost per barrel.	Cost above material per barrel.	Total cost per barrel.	Crude oil cost per barrel.	Cost above material per barrel.	Total cost per barrel.	Crude oil cost per barrel.	Cost above material per barrel.	Total cost per barrel.
1914	$0.702	$0.067	$0.769	.....	.....	.....	$0.581	$0.168	$0.749
1915	.593	.059	.652	.....	.....	.....	.522	.152	.674
1916	.789	.056	.845	$0.453	$0.149	$0.602	.546	.189	.735
1917	1.083	.087	1.170	.492	.144	.636	.719	.258	.977
1918	1.223	.123	1.346	.723	.183	.906	.784	.371	1.155
1919[1]	1.492	.139	1.631	.753	.197	.950	.860	.443	1.303

TABLE 74.—*Refining cost of five large companies, per barrel of 42 gallons, 1914–June 30, 1919*—Continued.

Year.	Company D.			Company E.			Total.		
	Crude oil cost per barrel.	Cost above material per barrel.	Total cost per barrel.	Crude oil cost per barrel.	Cost above material per barrel.	Total cost per barrel.	Crude oil cost per barrel.	Cost above material per barrel.	Total cost per barrel.
1914							$0.596	$0.155	$0.751
1915							.560	.138	.698
1916	$0.631	$0.138	$0.769	$0.577	$0.061	$0.638	.586	.152	.738
1917	.765	.164	.929	.715	.092	.807	.747	.195	.942
1918	.998	.192	1.190	1.036	.135	1.171	.892	.266	1.158
1919[1]	.943	.271	1.214	.934	.137	1.071	.932	.327	1.259

[1] First six months.

This information is given in detail, with index numbers based on the first year as 100, in Appendix Table 52, showing the relative increase in each item of cost.

The cost of refinery operations, i. e., the cost above material, increased for each company during the period. Such costs for company A increased 106 per cent from 1914 to June 30, 1919, those for company C increased 165 per cent during the same time, company D shows an increase of 96 per cent from 1916 to June 30, 1919, the costs of company B increased 32 per cent from 1916 to June 30, 1919, while those for company E showed an increase of 124 per cent from 1916 to June 30, 1919.

There is a wide variation in the refinery operating expenses for the different companies. Company C had the highest cost per barrel for the entire period, except in 1916, when company D had the highest cost. This is to be expected, as these companies operate very complete refineries.

The general and administrative expense increased greatly for each company throughout the entire period. Company C had by far the highest cost per barrel for general expense, company B was second highest each year for which its costs are shown, except in 1918, while company A shows the lowest cost for this item of expense.

Company C, on account of the completeness of its refineries, shows a much higher per barrel cost for depreciation than any other company throughout the entire period. The depreciation for company B is second highest per barrel refined throughout the period. The depreciation cost per barrel for company D and company A are practically the same each year except during the first six months of 1919, when the latter company was operated very much under its capacity, which greatly increased its depreciation cost per barrel refined.

Generally there was an increase in the cost of the crude petroleum beginning with 1916; this increase coincides with the trend of the cost of producing crude petroleum and with market prices for the crude. Fluctuations for individual companies, as for example company C, are the result of varying proportions of its own production and purchased oils run.

In 1916 some of the companies drew large quantities of crude petroleum from storage, which had been accumulated during years

of low crude prices, and as the cost of this quantity was comparatively low it reduced the general average to the lowest figure for the entire period except 1915.

The great difference shown by the several companies in the average cost of the crude petroleum run is largely due to differences in the proportions of the total refined which were produced and purchased. Differences in the cost of production of crude petroleum for different companies, differences in cost of transportation, and variations in the proportions drawn from storage were additional factors causing variations between the companies in the cost of the raw material refined. For example, company A shows the highest cost for crude and purchased oils refined in each year.

The difference in this item of cost for company A was greatest in 1919, when it was 58 per cent above that for the next highest company. This higher cost of crude for this company was due to the fact that from 1914 to June 30, 1919, this company purchased from 67 to 86 per cent of the crude run through its refineries. During the first half of 1919 it purchased considerable quantities of tops, i. e., unfinished naphtha and kerosene distillates and casing-head gasoline, which were mixed with crude in the field and transported to its refineries. These products are high priced and largely account for the higher cost of the crude and purchased unfinished oils run in that year.

The chief item in the cost of refined petroleum products is the raw material—crude petroleum. The other items are classified by the Commission as refinery operating, general and administrative, and depreciation. The raw material cost is the cost of crude petroleum and purchased unfinished oils delivered to the refineries, including basic costs plus handling and transportation charges. The refinery operating cost includes such items as labor, fuel, power, and steam, materials and supplies, maintenance, and repairs. General and administrative expense includes refinery office salaries and expenses, property taxes, insurance, royalties for the use of patented processes, general works expense, shipping expense, and the refinery pro rata of general office expense.

The percentage each element bears to the total cost of running a barrel of crude petroleum, as computed by the Commission, from 1914 to June 30, 1919, is shown in the following table:

TABLE 75.—*Proportion of items in cost of a barrel of refined petroleum, for five large companies, 1914–June 30, 1919.*

Item.	1914	1915	1916	1917	1918	1919[1]	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Crude and purchased oils	79.4	80.2	79.4	79.3	77.0	74.0	78.1
Operating	13.5	12.7	12.7	12.8	14.7	17.7	14.0
General and administrative	4.1	3.9	4.7	5.5	5.9	6.1	5.2
Depreciation	3.0	3.2	3.2	2.4	2.4	2.2	2.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] First 6 months.

The crude and purchased oils refined constituted from about 74 to over 80 per cent of the total costs, while the refinery operating expense varied from 12.7 to 17.7 per cent of the total. Deprecia-

tion is the only item that shows a much lower percentage during the later years.

The relative importance of the cost of the raw material—crude petroleum—of refinery operating expense, and of the general expense and depreciation combined is graphically shown in Chart II, opposite.

ANALYSIS OF OPERATING COST.—As already shown, the most important item of refining cost is the cost of the raw material—crude oil—while the refinery operating cost during the period 1914–June 30, 1919, constituted only from 12.7 per cent to 17.7 per cent of the total cost per barrel. It is apparent that a small increase in the cost of any of the items which are included in the cost of operating a petroleum refinery can not have a great effect on the total cost of refining a barrel of crude oil. The following table gives an analysis of the refinery operating expense and shows the combined actual cost per barrel refined, of labor, fuel, power, and steam, material and supplies, maintenance and repairs, and the total operating expense, together with the index numbers, based on 1914 as 100, for each item, for the five large refining companies in California, 1914 to June 30, 1919:

TABLE 76.—*Importance of items in refinery operating expense, per barrel, for five large companies, 1914–June 30, 1919.*

Year.	Labor.		Fuel, power, and steam.		Material and supplies.		Maintenance and repairs.		Total refinery operating.	
	Cost per barrel.	Index No.	Cost per barrel.	Index No.	Cost per barrel.	Index No.	Cost per barrel.	Index No.	Cost per barrel.	Index No.
1914	$0.012	100	$0.035	100	$0.046	100	$0.009	100	$0.102	100
1915	.016	129	.029	84	.036	78	.008	85	.089	87
1916	.020	160	.030	86	.035	77	.009	94	.094	92
1917	.023	195	.039	113	.046	100	.012	130	.120	118
1918	.033	274	.060	174	.058	127	.019	203	.170	167
1919 [1]	.046	374	.066	191	.089	195	.021	230	.222	218

[1] First 6 months.

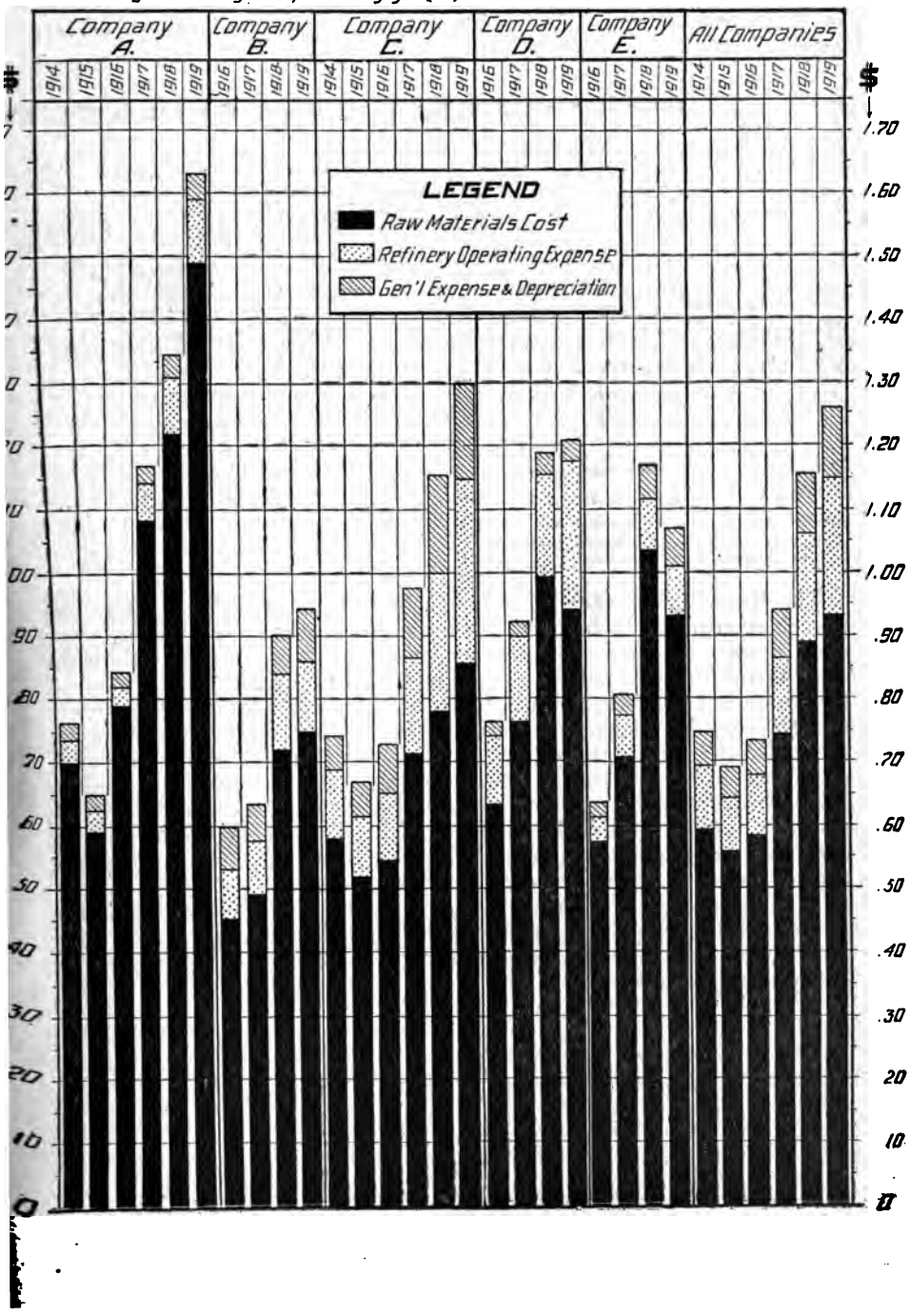
The cost of material and supplies is the largest single item and constitutes from about 30 to 40 per cent of the total refinery operating expense, fuel, power and steam are next in importance, constituting approximately from 30 to 35 per cent of the total. The refinery labor is relatively small and for most years was less than 20 per cent of the refinery operating expense; that is, the refinery labor item constituted only from 1.6 to 3.7 per cent of the total cost of refining a barrel of crude petroleum in California during the period 1914–June 30, 1919.

ALLOCATION OF COSTS TO PRODUCTS.—As already stated, there is no method by which an entirely satisfactory cost can be computed for the different refined petroleum products. However, it is highly desirable to show the cost per product according to the best method available. The Commission has adopted the method of allocating costs to the various products on the basis of sales value. This method, as already stated, was generally approved by representatives of the petroleum refining business, as the fairest and most satisfactory

CHART II.

COST OF CRUDE OIL, REFINERY OPERATING EXPENSE, GENERAL EXPENSE AND DEPRECIATION PER BARREL IN REFINING CRUDE PETROLEUM

for 5 large Refining Companies by years, 1914 to 1918 and for first 6 months of 1919.



method of computing such a cost for the purpose of considering the reasonableness of prices.

This method of allocating the cost elements to the different products shows the highest cost for the most valuable and the lowest cost for the lowest priced product, and gives to each the same percentage of profit or loss. Table 77 shows the combined cost of each important petroleum product for the five large refining companies in California, for the first six months of 1919, according to this method:

TABLE 77.—*Allocation of refining cost to principal products, for five large companies, first 6 months, 1919.*

Product.	Average yield from a barrel of crude oil, in gallons.	Average f. o. b. refinery price per gallon.	Refinery realization per barrel of crude oil.	Percentage of realization.	Total cost of quantity secured from a barrel of crude oil.[1]	Cost per gallon.
Gasoline	4.1496	$0.1516	$0.62908	27.6408	$0.3481	$0.084
Engine distillate	1.4196	.0811	.11513	5.0586	.0637	.045
Kerosene	3.0240	.0522	.15785	6.9357	.0874	.029
Fuel and gas oil	29.9166	.0347	1.03811	45.6130	.5744	.019
Lubricating oil	.9282	.2052	.19047	8.3690	.1054	.114
Asphaltum	.4536	.0707	.03207	1.4091	.0177	.038
Other products	1.1928	.0949	.11320	4.9738	.0626	.053
Total products	41.0844					
Refining loss	.9156					
Total	42.0000	.0542	2.27591	100.0000	1.2593	[2].031

[1] Determined by allocating costs in proportion to value of products.
[2] Cost per gallon for all products.

The quantity of each product secured from refining a 42-gallon barrel of crude petroleum is obtained by applying the average per cent of yield shown for the five large refining companies in California to a barrel of crude petroleum. The f. o. b. refinery price is secured by deducting the freight and marketing expenses from the sale price, and the refinery realization for each product is the products obtained by multiplying the quantity of that product refined from a barrel of crude by the f. o. b. refinery realized price. The percentage of realization is the quotient resulting from dividing the realization for each product by the total realization for all products. The total cost for each of the principal products produced is obtained by multiplying the total cost of refining a barrel of crude petroleum—that is, $1.259—by the percentage of realization for each product, as shown in column 4; while the cost per gallon for each product is secured by dividing the total cost of the quantity secured from a barrel of crude oil by the quantity produced.

The cost per product as obtained by the above method for the five large refining companies operating in California, from 1914 to June 30, 1919, is given in Table 78.

TABLE 78.—*Cost of principal petroleum products, based on sales realization, for 5 large companies, 1914–June 30, 1919.*

Year.	Gasoline, per gallon.	Engine distillate, per gallon.	Kerosene, per gallon.	Fuel and gas oil, per barrel.	Lubricating oils, per gallon.	Asphaltum, per gallon.	Other product, per gallon.	Actual cost, per barrel.
1914	$0.060	$0.022	$0.025	$0.403	$0.106	$0.022	$0.029	$0.751
1915	.052	.031	.028	.395	.102	.023	.023	.698
1916	.079	.032	.028	.328	.078	.018	.031	.738
1917	.088	.037	.027	.445	.091	.022	.042	.942
1918	.083	.038	.027	.630	.093	.028	.049	1.158
1919[1]	.084	.045	.029	.806	.114	.038	.053	1.259

[1] First 6 months.

For this period the cost of all the different products, as computed by this method, increased. Gasoline increased about 40 per cent, as compared with approximately 68 per cent for the actual cost of refining a barrel of crude petroleum. Engine distillate, on account of the greatly increased demand, advanced in price more than most other products; hence its cost by this method shows a large increase, which during the period 1914 to June 30, 1919, equaled about 105 per cent. Kerosene, on the other hand, shows an increase of only 16 per cent in 1919 as compared with 1914. This was due to its comparative stability of price. Fuel and gas oil show an increase of about 100 per cent. Lubricating oils show an increase of only 8 per cent, asphaltum about 73 per cent, and all other products about 83 per cent.

The costs shown for particular products by this method are not strictly comparable from year to year, because the selling prices of the different products do not increase or decrease in the same proportion.

COSTS BASED ON CRUDE AT MARKET PRICE.—In the preceding presentation of costs, the raw material—crude petroleum—has been included at its cost to each company. In other words, all profit to the producing departments have been eliminated for that portion of the crude refined which was produced by the refining company, and the profits to the pipe lines owned or controlled have also been deducted. This gives the actual cost for the highly integrated companies. As already shown, there are 21 smaller refiners in California, some of which have no crude production and have to transport their crude to their refineries largely by rail in tank cars. Such refiners operate at a decided disadvantage when in competition with other refiners who have their own pipe-line facilities and produce a large part of their requirements. Moreover, in the case of a company having its own production and pipe lines, where it is desirable to show departmental earnings, it is necessary to charge the company's own production to the refining department at the market price of crude plus the regular tariff rate of transportation.

Table 79 shows a comparison between computed cost of refining crude petroleum per barrel for the five large refining companies in California combined, with crude petroleum computed at market price

plus the tariff rate for pipe-line transportation, and the actual cost of refining crude petroleum, 1914–June 30, 1919:

TABLE 79.—*Comparison of the computed cost of refining crude petroleum with the crude charged at market price and pipe-line transportation tariff rates, with the actual cost for five large companies, 1914–June 30, 1919.*

Year.	Refining cost with crude at market and transportation charges at tariff rates.	Actual refining cost.[1]	Difference in cost.	Percentage of difference.
1914	$0.994	$0.751	$0.243	32.3
1915	.838	.698	.140	20.0
1916	1.082	.738	.344	46.6
1917	1,428	.942	.486	51.5
1918	1.794	1.158	.636	54.9
1919[2]	1.951	1.259	.692	54.9

[1] Table 78. [2] First 6 months.

The computed refining cost for the Associated Oil Co., the Standard Oil Co. (California), and the Union Oil Co. of California for the entire period, and the Shell Co. of California for the first six months of 1919, are computed from figures submitted by the companies. In determining the computed refining cost for the Shell Co. of California for the years 1916–1918, the Commission has used the average price paid for crude petroleum purchased by other companies, aggregating from 1,000,000 to 1,500,000 barrels per year of crude from the fields from which the Shell Co. of California secured its supply. The market price of crude petroleum consumed by the General Petroleum Corporation for the period 1916–1919 is based on purchases by other companies of from 2,750,000 to 4,000,000 barrels per year of the grade of crude used by this company.

The final column of the above table shows the per cent by which the average refining costs of these companies would have exceeded their actual cost had they purchased all of their refinery requirements of crude petroleum at the current market price and paid the regular tariff rates for pipe-line transportation. The average refining cost per barrel of crude petroleum run would have varied from 20 per cent in 1915 to 55 per cent in 1919 higher than the actual average cost had these companies been required to purchase all of the crude oil at the posted market price and paid the regular tariff rates for pipe-line transportation. Individual companies included in the above averages would have had a cost ranging as high as 128 per cent above their actual cost had they no production or pipe-line facilities of their own.

The combined results for all five companies emphasize the tremendous handicap any refiner without crude petroleum production and adequate pipe-line facilities would encounter in attempting to become a factor in the Pacific coast market. Even with a considerable production of crude petroleum such a refiner would probably be unable to survive unless there were a considerable reduction in pipe-line rates and his refinery were near the oil fields and the consuming markets. (See Ch. VII.)

4. Refinery realizations.

eady shown, the five large integrated companies refined from 90 to about 92 per cent of all the crude-petroleum refined in ia during the period covered by this report. (See p. 179.) he quantity of refinery sales and the amount realized there- o. b. refinery, and the average refinery realization per gallon particular interest. Appendix Table 53 shows the quantity ount of the combined sales, f. o. b. refinery, and the average ion per gallon for the five large refiners in California. The f. o. b. refinery realization is shown in the following table:

.—*Combined average f. o. b. refinery realization per gallon for petroleum products sold by five large companies, 1914–June 30, 1919.*

Product.	1914	1915	1916	1917	1918	1919[1]
.....	$0.091	$0.075	$0.142	$0.158	$0.158	$0.152
illate.....	.033	.044	.058	.065	.072	.081
.....	.038	.040	.050	.049	.051	.052
.....	.015	.014	.014	.019	.028	.035
.....	.018	.020	.024	.030	.047	.048
oil.....	.161	.148	.141	.163	.176	.205
.....	.033	.033	.033	.040	.053	.071
icts.....	.043	.034	.055	.076	.093	.095
ge.....	.024	.023	.029	.038	.050	.057

ionths.

e table above the amount received for the different quantities s been reduced to an f. o. b. refinery basis by deducting marketing costs, and all other expenses incurred in the dis- n of the various petroleum products. For all products except the quantities shown above represent the bulk of such sales Pacific coast territory. Large quantities of heavy low-grade etroleum are sold for fuel purposes without refining; hence ntities represent a much smaller proportion of this product the other products shown.

amount received f. o. b. refinery increased much more from 1918 than the increase in quantity. The increase in quantity out 75 per cent, while the amount realized increased about cent. The refinery realizations in 1914 and 1915 were ly low, due to depressed conditions in the industry resulting large over-production of crude petroleum, while during 1917 8 the large demand for war purposes led to increased prices. verage f. o. b. refinery realization for gasoline increased from s per gallon in 1914 to almost 15.8 cents in 1918, and then de- o 15.2 cents for the first half of 1919. This represents an in- f about 74 per cent for the former years and 67 per cent for Engine distillate increased from 3.3 cents per gallon in 1914 to s in 1919, which represents an advance of 145 per cent. The emand for engine distillate as a motor fuel for farm tractors e principal factor in causing this large increase. The com- ely low per gallon realization for kerosene was due to the t most kerosene was sold for export shipments at very low he increase from 1914 to June 30, 1919, being about 37 per The average f. o. b. refinery realization per gallon for fuel oil d almost 133 per cent from 1914 to June 30, 1919; much of

this increase occurred in 1919. The large demand for bunker purposes was the chief cause of this large increase. Gas oil also shows a large increase; in 1914 the f. o. b. refinery realization was only 1.8 cents per gallon, while it increased to 4.8 cents for the first half of 1919, or a 167 per cent advance. The per gallon realization for lubricating oils began to increase slightly in 1916 and by June 30, 1919, it was 27 per cent higher than in 1914. Asphaltum and "Other products" increased 115 per cent and 121 per cent, respectively, from 1914 to the middle of 1919.

Section 5. Refinery investment.

INVESTMENT AS OF DECEMBER 31, 1919.—The gross plant investment in refineries on December 31, 1919, for the five large refining companies in California, as shown by their books, was $47,076,548. This total represents the actual cost of the original refining plants plus the cost of additions and betterments made from time to time. The reserve for depreciation, as shown by the companies' books, amounted to $11,566,957 on December 31, 1919, leaving a net plant investment of $35,509,591. The fixed refinery investment on December 31, 1919, for each of the five companies, as shown by their books, is given in Table 81:

TABLE 81.—*Investment in refineries, for five large companies, as shown by their records, Dec. 31, 1919.*

Company.	Gross investment.	Depreciation.	Net investment.
Standard Oil Co. (California)	$30,594,907.07	$7,808,982.29	$22,785,924.78
Union Oil Co. of California	7,198,375.16	1,208,999.41	5,989,375.75
Shell Co. of California	4,517,617.54	1,479,832.68	3,037,784.86
Associated Oil Co.	2,835,204.69	916,544.20	1,918,660.49
General Petroleum Corporation	1,419,783.56	152,598.43	1,267,185.13
Total	46,565,888.02	11,566,957.01	34,998,931.01

The investment figures shown above include refinery sites and refinery plants and equipment, including receiving and storage tanks located at the refinery. In the case of the Standard Oil Co. (California) the investment in refinery property is large, as this company includes its investment in tank farms in its refinery plant account. The reason given by this company for the inclusion of their tank farm investment is because this storage equipment is used for the storage of crude petroleum to meet refinery requirements.

INVESTMENT FROM 1914 TO JUNE 30, 1919.—Information relative to the cost of refining crude petroleum was obtained for the years 1914 to June 30, 1919, and, in order to show the rate of earnings for the same period the refinery investment at the close of each year and for June 30, 1919, was secured. The Commission made an adjustment in the depreciation charge and the rate of 5 per cent was adopted in order to make the costs for the different companies more nearly comparable. The gross plant investment, the depreciation as charged by the companies, the Commission's depreciation adjustment, the net refinery working capital, and the net refinery investment, as shown by the companies' books and by the Commission, is given in Appendix Table 54.

he investment for the Standard Oil Co. (California), the Associd Oil Co., and the Union Oil Co. of California is shown for the ire period, while the earliest investment figures for the other two ıpanies are for 1916. In 1917, the first year for which the investıt for all five companies is shown, the gross investment was ,251,588 and the net investment after deducting 5 per cent depreiion was $27,275,036. By June 30, 1919, the gross investment had eased to $43,269,430 and the net investment to $32,142,456. s represents an increase of about 23 per cent in the gross investıt and about 18 per cent in the net investment.

he large investment of the Standard Oil Co. (California) is indica- of its importance in the refining business of California. During period 1914–June 30, 1919, its gross refinery investment eased from $16,961,519 to $29,441,627, an increase of almost 74 cent. In 1916 and 1917 the gross refinery investment for the ndard Oil Co. (California) was 70 per cent of the total for all five ıpanies, in 1918 it was 69 per cent, and on June 30, 1919, 68 per t of the total.

he net working capital represents inventories of crude and refined , inventories of other materials and supplies, cash, accounts and es receivable, from the total of which have been deducted the sum ıccounts and notes payable, and accrued liabilities. These items e prorated to the various departments, such as oil producing, pipe s, marine, refining, and marketing by the companies themselves, he request of the Commission. The net working capital of the ndard Oil Co. (California) forms a much larger proportion of its ıl refinery investment than that for any other company. This is partly to its large stocks of finished and semifinished products . partly to the fact that this company carries its entire crude oil ks in the refining department.

he refinery investment of the Standard Oil Co. (California), as already been pointed out, includes the investment in tank farms . tank farm equipment. The tank farms are held for the storage rude oil, and as the Standard sells no crude but holds it all for nery requirements, it is contended that the tank farms are necesly a part of the refinery equipment. The crude oil storage acity for this company was at the end of 1919 approximately)00,000 barrels, and at least 75 per cent of this tankage was empty ing 1919. The refinery requirements are about 35,000,000 barrels ear, or almost 3,000,000 barrels per month. The reserve crude roleum held in storage in 1919 would have been sufficient to keep ir refineries running at full capacity for about three and one-half ıths, if no crude were secured from other sources.

NVESTMENT PER BARREL ON RATED CAPACITY.—The refinery intment per barrel on the rated daily capacity of the plant varies ıtly, depending upon the completeness of the refinery operations. rated daily capacity is meant the quantity of crude petroleum ch it is possible to run through a given plant in 24 hours. The ıeries of California may be classified as follows: (1) Lubricating ıts and (2) light-products plants. The lubricating plants are e complete refineries than the light-products plants and obtain rger number of products than the light-products plants from a el of crude petroleum and a correspondingly smaller yield of re-

siduum or fuel oil. The refineries called light-products plants in California are called skimming plants in the Mid-Continent field. As the terms imply, such plants secure only a few light products, such as gasoline, kerosene, and high-grade distillates, from a barrel of crude petroleum, while their yield of residuum or fuel oil is large. Table 82 gives the location of the refinery, the gross refinery investment, the rated daily capacity, and the average investment per barrel for each plant operated by the five large refining companies in California, as of June 30, 1919.

TABLE 82.—*Gross plant investment and investment per barrel of rated daily capacity for lubricating and light products plants, June 30, 1919.*

Company.	Plant.	Gross plant investment.	Rated daily capacity.	Average investment per barrel.
			Barrels.	
Lubricating-oil plants:				
Standard Oil Co. (California)	Richmond	$15,864,080.41	60,000	$264.40
Do	El Segundo	7,003,425.79	35,500	231.25
Union Oil Co. of California	Oleum	2,647,268.60	22,000	120.32
Shell Co. of California	Martinez	4,173,534.54	30,000	139.12
Total		29,688,309.34	147,500	201.28
Light-products plants:				
Standard Oil Co. (California)	Bakersfield	940,298.05	20,000	47.02
Union Oil Co. of California	Avila	567,324.89	17,000	33.37
Do	Maltha	228,345.24	3,000	96.11
Do	Santa Paula	22,741.43	800	28.32
Do	Brea	216,838.13	10,000	21.69
Associated Oil Co	Avon	1,930,620.41	22,000	87.76
Do	Gaviota	603,898.39	10,000	60.39
General Petroleum Corporation	Vernon	1,244,312.42	20,000	62.21
Shell Co. of California	Coalinga	93,893.36	2,000	46.14
Total		5,848,272.32	104,800	55.80

As already stated, the investment per barrel differs greatly for the two types of plant, and, as shown above, it varies widely for the same type of plant, depending upon its degree of completeness and the character of its equipment. The investment for lubricating plants varies from $120.32 per barrel to $264.40 per barrel. The plant of the Standard Oil Co. (California) at Richmond shows the highest investment per barrel; which is partly due to its investment in Burton Process pressure stills, enabling it to secure a higher percentage of gasoline.

The investment per barrel for the light-products plants ranges much lower than those having lubricating stills. This investment varies from $21.60 per barrel to $96.11 per barrel, while the average is $55.80, as compared with $201.28 for the four lubricating plants.

INVESTMENT PER BARREL OF CRUDE CONSUMED.—The investment per barrel of crude and unfinished oils run through a refinery furnishes a convenient unit for expressing costs, realizations, and earnings. Such investment, like that shown on the basis of the rated daily capacity, varied greatly for different plants and types of plants, depending upon their completeness, and it is also greatly affected by the percentage of capacity at which the plant is operated. Appendix Table 55 shows the net refinery investment, including working capital, the quantity of crude and purchased unfinished oils run per year, and the average investment per barrel run for the five large refining companies in California, 1914 to June 30, 1919.

The average per barrel of crude run has been computed on an ınual basis; that is, in case of a six-month period, as in 1919, it has ɔen assumed that the annual consumption would be double that for ıe half year. The investment is the net investment, including work-ıg capital, and, as a rule, the investment has increased faster than ıe consumption. The average for all five companies for 1916, the rst year for which there are figures for all five, was about 85 cents er barrel. In 1917, owing to the large increase in the consumption, ɔcompanied by a small increase in investment, the average fell to bout 78 cents per barrel, while for 1918 it increased to 94 cents nd by June 30, 1919, to almost 98 cents per barrel, this increase eing due to decreased refinery runs.

The Standard Oil Co. (California) shows by far the largest invest-ıent per barrel. As already shown, this company has a large fixed ıvestment and also a large working capital, which results partly om the fact that two of its refineries are large lubricating plants ıd that it makes use of Burton Process pressure stills, which require ɔmparatively heavy plant investment, and partly to the inclusion a large storage investment in its refinery plant account. In 1914 .e average for this company was about $1.07, while by June 30, 1919, had increased to almost $1.35 per barrel. The results for the different ɔars are quite variable, depending on the relation between the crease in the investment and the quantity of crude and purchased ıfinished oils consumed. In 1915 the investment per barrel de-eased from about $1.07 in 1914 to about $1.04, and in 1917 there as a big decline as compared with 1916 from about $1.18 in the rlier year to about $1.07 in 1917. In both cases the consumption as very large as compared with the previous year, while the increase investment was comparatively small.

The Shell Co. of California shows the second largest investment ɔr barrel. The larger of its two refineries is a lubricating plant, ıd it has not operated its refineries to as high a percentage of capac-y as have the other companies. Data for this company cover the ɔars 1916 to 1919. The investment per barrel increased from 85 nts in 1916 to $1.04 in 1919. In 1917 there was a decline from ɔ cents to 76 cents per barrel, which was due to a large increase in e quantity refined accompanied by a small increase in investment.

The Union Oil Co. of California shows a much lower investment r barrel than either of the other companies already discussed. ıis was due to the fact that during the period covered only one of five plants was equipped to produce lubricants. During the ·e-year period the investment of this company increased 127 per nt, while its consumption was increased only about 44 per cent, ɜulting in an increase of 57 per cent in the investment per barrel fined.

The Associated Oil Co. shows a higher investment, including ɔrking capital in 1916, than for any other year. Its refineries e both light-products plants. Its consumption of crude petroleum ɔreased rapidly from 1914 to the maximum in 1917. In 1918 ere was a decline to less than the 1916 total, while that for the ɜt half of 1919 indicated a still smaller consumption for the year. ıe investment per barrel run decreased steadily from about 37 ıts per barrel in 1914 to about 27 cents in 1917. In 1918 there ɜs a considerable increase as compared with the preceding year,

due to a falling off in consumption, accompanied by an increase in investment. The investment per barrel was larger for 1914 than for any other year except 1919.

The General Petroleum Corporation has a smaller investment per barrel run than any of the other large companies. This is largely due to the fact that its plant produces only light products and fuel oil. In 1916 the investment per barrel was only 10 cents, the following year the investment increased 149 per cent, while the consumption increased 115 per cent and the investment per barrel increased 115 per cent. In 1918 and 1919 the investment was further increased, while the quantity of crude oil consumed declined from the 1916 total; hence there was a very large increase in the investment per barrel. From 1916 to 1919 the investment per barrel of crude run increased from 10 cents to almost 30 cents per barrel, which represented a gain of 200 per cent. Notwithstanding this large increase in the investment per barrel, the General Petroleum Corporation's highest figure was lower than that for any other large company for each year excepting the Associated Oil Co. in 1917.

Section 6. Marketing investment.

TOTAL INVESTMENT.—The net investment, including working capital, for the marketing equipment of the Standard Oil Co. (California), the Union Oil Co. of California, the Associated Oil Co., and the Shell Co. of California amounted to $38,478,932 on December 31, 1916, the first year for which the investment for all four companies was obtained, and by June 30, 1919, it had increased to $53,536,867; this represents a gain of 39.1 per cent in only two and one-half years. This investment covers the domestic marketing equipment in all of the States in which each company markets its products in the Pacific coast territory. (See Pt. II, Ch. II.) The General Petroleum Corporation sells practically all of its petroleum products, except fuel oil, f. o. b. refinery; therefore, this company has no investment in a marketing department. The fuel oil is sold in bulk, hence this company has a very small investment in marketing equipment. The gross and net marketing investment, depreciation, net working capital, and net investment, including net working capital, are shown in Appendix Table 56.

The figures in this table represent the investment in the marketing equipment as shown by the books of the different companies, with the exception that deferred charges have been eliminated by the Commission. The net working capital was assigned to the marketing department by representatives of each company. The marketing investment covers the plant and equipment used in storing, selling, and distributing refined products, and both the crude fuel oil and refinery residuum sold as fuel oil. It is impossible to show separately the investment used exclusively in distributing refinery products or that used in marketing crude fuel oil.

The combined net investment for the four companies, including net working capital, increased throughout the period. This investment is shown for two companies in 1914, three in 1915, and four for the remainder of the period. In 1916 the investment for the Standard Oil Co. (California) was 46.3 per cent of the total, while on June 30, 1919, it was 44.8 per cent; the Union Oil Co. of California

ad 36.1 per cent of the investment at the end of 1916 and 36.7 per ent on June 30, 1919; the Associated Oil Co., which has the third rgest marketing investment, had 12.1 per cent of the total on ecember 31, 1916, and 14.7 per cent at the middle of 1919, while ie marketing investment of the Shell Co. of California declined om 5.4 per cent at the end of 1916 to 3.8 per cent at the end of une, 1919.

INVESTMENT PER BARREL SOLD.—The net marketing investment, ncluding net working capital per barrel of all petroleum products old for the four large marketing companies operating in the Pacific oast territory for the period 1914–June 30, 1919, is shown in Appendix Table 57.

The six-month period for 1919 has been computed on an annual asis on the assumption that the six months' sales represented half f the year's total. This table shows almost a steady increase in he average net investment per barrel for all companies from 1914 to une 30, 1919. In 1914 the average for the Associated Oil Co. and the tandard Oil Co. combined was about 50 cents per barrel, while n June 30, 1919, for all four companies it was almost 93 cents per arrel. This represents a net gain of practically 86 per cent in the our and one-half years. From 1915 to 1917 there was only a slight ain, due to the relatively rapid increase in the quantity sold as compared with the increase in investment. In 1918 and 1919 the net nvestment increased, while sales declined as compared with 1917, esulting in a large increase in the average net investment per barrel. The Union Oil Co. of California shows the highest average investment per barrel throughout the period and the Associated Oil Co. he lowest for a single year, while that for the Shell Co. of California was lowest in the last two years.

The quantity of petroleum products sold by the four large marketers increased from 60,197,069 barrels in 1916 to 65,230,750 arrels in 1918, while the sales for the first half of 1919 indicated a lecrease at the rate of 9 per cent for the year. There were some hanges in the percentages which each company sold of the total ales for the four companies during the period. In 1916 the Standard Oil Co. sold about 44 per cent of this total quantity, hile in the first half of 1919 its proportion was 46 per cent; the Union Oil Col. of California sold 16 per cent in 1916 and for the first x months of 1919 it sold 21 per cent; the Associated Oil Co. showed decline from 30 per cent in 1916 to 22 per cent on June 30, 1919, hile the Shell Co. of California had 10 per cent of the sales in the arlier year and 11 per cent for the later period.

ection 7. Earnings on refining and marketing investment.[5]

TOTAL EARNINGS.—Any presentation of earnings for the refinery nd marketing operations of the five large companies in California is iore or less arbitrary. Three of the companies furnished statements iowing such departmental earnings, while the other two did not iow separate earnings for refining and marketing. As already iown, the activities of these five interests, except in the case of the eneral Petroleum Corporation, extend to every branch of the petroum business of the Pacific coast. They all produce a large proortion of the crude petroleum required for their refinery operations,

[5] See Ch. V for earnings of all operations.

own or control the pipe lines and tank steamers in which the crude is transported to their plants, operate refineries, and, except in the case of the General Petroleum Corporation, have extensive marketing organizations for the distribution of their refined products. Hence it is evident that the presentation of earnings by departments involves the transfer of materials or services from one department to another, not at actual cost, but at a price at which materials could be sold or services rendered to outside companies at a profit. Three of the large refining companies, viz, the Associated Oil Co., Standard Oil Co. (California), and the Union Oil Co. of California, furnished statements showing income by departments. In setting up these departmental earnings the refineries were charged and the producing department credited with the crude petroleum produced by the company and run through the refinery at the posted market price of crude petroleum at the wells for the same gravity crude plus transportation charges. The rates allowed for transportation by pipe line are in some cases the rates filed with the State railroad commission for common-carrier shipments, while in other cases and for tank steamers they are arbitrary charges of the company, as there have been no common-carrier tariffs filed for such transportation.

The earnings for the refinery and marketing departments shown by the company records represent the income from sales, net, on an f. o. b. refinery basis, the cost of packages, outgoing freight, trade discounts, returned sales, and marketing expenses having been deducted. The net refinery and marketing income for the companies showing earnings by departments, and such earnings as adjusted by the Commission, are shown in Appendix Table 58.

The first column shows the earnings for the refining and marketing departments as reported by the companies, the second the adjustment necessary to place all depreciation on a 5 per cent basis, and the last column the net refinery and marketing earnings after the adjustment to a uniform depreciation basis.

The Shell Co. of California and the General Petroleum Corporation did not show departmental earnings. In order to secure results for these companies comparable with those for the other three large integrated companies, and also to enable a comparison to be made of the operations of the producing department of these two companies with those for companies engaged only in production, the Commission has shown separate earnings for marketing and refining. The earnings for all operations of these companies, the earnings computed by the Commission for the producing department by allowing the current market price for crude petroleum refined, depreciation adjusted to 5 per cent, and, in the case of the General Petroleum Corporation, the deduction of earnings for the marine department and nonoperating income as reported by the company, and the earnings thus determined by the Commission for the refinery and marketing departments, are shown in Appendix Table 59.

The total earnings for all departments, as shown by the companies' books, are given on the first line for each company. In the case of the General Petroleum Corporation earnings of the marine department and nonoperating income, as shown by the company's books, have been deducted from the total earnings. The earnings computed by the Commission for the producing departments of both companies as obtained by charging the refineries the current market price for the

› petroleum refined have been deducted, and the difference een the depreciation charged by the companies and that com- l by the Commission at 5 per cent has been added back to the ›anies' earnings.

.TE OF EARNINGS.—The rate of earnings on the refining and mar- g investment has been computed on the net investment, including ing capital as of December 31 for the first year and on the mean tment, i. e., one-half of the sum of the investment at the begin- and end of the year, for the succeeding years. Data are not able to compute the mean investment for the first year for each ›any, and the investment at the end of the year has been used for rst year shown. The mean investment is used rather than that e first of the year, as it makes allowance for any extraordinary ase which may have occurred in the investment during the year. following table shows the net investment, including working al as of December 31, for the first year and the mean investment ıe later years, and the net income for refining and marketing as ed by the Commission, and the rate of earnings on this basis, 1914 ıne 30, 1919.

: 83.—*Net refining and marketing investment, net earnings, as revised by the Com- ission, and the rate of earnings for four large companies,*[1] *1914–June 30, 1919.*

Year and company.	Net refining and marketing investment.[2]	Net earnings.	Annual basis.
Standard Oil Co. (California).			*Per cent.*
	$44,618,277.64	$1,974,513.58	4.43
	44,670,422.10	3,088,045.19	6.91
	47,455,217.17	2,182,223.98	4.60
	52,280,271.99	3,454,393.60	6.61
	58,074,312.37	14,735,810.76	25.37
	63,796,753.06	5,791,865.99	18.16
Union Oil Co. of California.			
	12,637,859.05	494,365.03	3.91
	13,313,260.74	609,394.86	4.58
	15,946,589.62	1,739,260.21	10.91
	19,708,193.92	2,159,112.70	10.96
	23,511,021.15	1,666,284.24	7.09
	25,992,871.47	2,254,483.59	17.34
Shell Co. of California.			
	7,057,336.58	6,022.19	.09
	7,152,744.25	30,891.85	.43
	7,941,848.97	[3] 794,292.39	[3] 10.00
	9,163,691.91	[3] 1,499,794.14	[3] 32.72
Associated Oil Co.			
	7,251,532.44	[3] 724,140.89	[3] 9.99
	6,873,283.86	[3] 844,071.39	[3] 12.28
	6,848,389.39	[3] 1,626,794.94	[3] 23.75
	7,068,759.71	[3] 1,205,704.86	[3] 17.06
	7,887,720.02	1,915,294.12	24.28
	9,674,320.39	1,104,881.12	22.84
Total 4 companies.			
	64,507,669.13	1,744,737.72	2.70
	64,856,966.70	2,853,368.66	4.40
	77,307,532.76	2,300,711.44	2.98
	86,209,969.87	4,438,693.29	5.15
	97,414,902.51	17,523,096.73	17.99
	108,627,636.83	7,651,436.56	14.09

General Petroleum Corporation is omitted from this table, as most of its products are sold at ıle, and, having a very small refining and marketing investment, its rates of earnings are not compar- th the other 4 large companies.
estment in tank farms deducted.
3.
t 6 months.

The General Petroleum Corporation sells its products principally at wholesale on an f. o. b. refinery basis, and having a comparatively small refinery and practically no marketing investment, its activities in these branches are not comparable with those for the companies shown in the above table.

The rate of earnings as computed by the Commission is slightly higher for the Standard Oil Co. (California) and the Union Oil Co. of California than that computed on the companies' reported earnings throughout the entire period. In the case of the Associated Oil Co. the loss, as shown by the Commission, is slightly higher than that shown by the company for the period 1914–1917, and profit during 1918 and the first half of 1919 is also greater than that based on the company's statement. The Shell Co. of California shows a small profit on its refinery and marketing departments for 1916 and 1917, while a loss is shown for 1918 and 1919. The combined earnings for all four companies show a small rate of earnings except in 1918 and the first half of 1919. In 1914 the combined total includes only two companies, while from 1917 to June 30, 1919, all four are included.

SIGNIFICANCE OF THE RATE OF EARNINGS.—In the preceding paragraphs of this chapter the refining and marketing departments have been placed on an equal footing with a refining company having to purchase all of its crude petroleum at the current market price and having to pay the regular tariff rates for pipe-line service. As shown in the preceding tables, two companies show a profit for their refining and marketing departments on this basis for each year for which the rate of earnings are shown, while the other two companies show losses for most years. The two companies showing the most favorable results for these departments operate the most complete refining plants. A comparison of the rate of earnings with those shown in Chapter V for the entire oil business of each company shows that as a rule the profits on refining and marketing have been materially lower than those for the combined business of these companies; in other words, other departments, such as the producing and transporting (principally pipe line), have been more profitable than the refining and marketing departments. This low rate of earnings or actual loss for the refining and marketing departments of the large companies shows the great handicap the small refiner, who has no production or pipe lines, encounters in attempting to develop a refining and marketing business. As a matter of fact, the small refiner is a very small factor in the refining and marketing business of California. As already shown, in 1919 the small operators owned 23 plants out of a total of 38 for the State, but they refined only about 9 per cent of the total crude consumed by refineries.

MARGIN OF PROFIT ON PRODUCTS.—The cost of particular products as computed on the basis of refinery yield and sales realization has been shown in section 3, while the margin of profit as determined by deducting such costs from the f. o. b. refinery realization for gasoline, engine distillate, kerosene, fuel and gas oil, lubricating oils, asphaltum, and other products, and the margin between f. o. b. sales realization and the actual cost of refining a barrel of crude oil is shown in Appendix Table 60.

While the cost of refining increased steadily from 1914 to 1919, excepting during 1915, the f. o. b. refinery sales realization increased at an even greater rate, which resulted in a constantly increasing

margin of profit throughout the entire period. The actual cost of refining a barrel of crude oil increased about 68 per cent from 1914 to June 30, 1919, the f. o. b. sales realization increased 100 per cent, while the margin of profit per barrel increased almost 162 per cent.

The margins for the particular products show considerable fluctuation due to the fact that the changes in price were not uniform for all products. Gasoline shows its smallest margin in 1915 and its largest margin in 1918. From 1914 to June 30, 1919, it shows an increase of almost 118 per cent, as compared with an increase of 162 per cent for all products. The margin for engine distillate increased 220 per cent from 1914 to June 30, 1919. The year 1919 shows the largest margin. The largest margin for kerosene is shown for 1918, the smallest for 1915, while that for 1914 was next to the smallest. The increase in the first half of 1919 over 1914 was about 80 per cent. Fuel and gas oil show a constantly increasing margin, which increased almost 216 per cent from 1914 to June 30, 1919. The margin of profit for lubricating oils increased from 1915 to 1919. The increase from 1914 to June 30, 1919, was about 67 per cent. Other products show an increase each year over the preceding year except during 1915 and the first half of 1919. From 1914 to June 30, 1919, the margin of profit on other products increased about 188 per cent.

CHAPTER IX.

GENERAL CONDITIONS IN THE UNITED STATES DURING 1919.

Section 1. Source of information.

On June 1, 1920, the Commission submitted a report to Congress on The Advance in Price of Petroleum Products. This report was made in response to House resolution 501, Sixty-sixth Congress, second session, which was adopted April 5, 1920. Owing to the brief time allowed to report on this inquiry, much of the information in answer to the schedules sent out by the Commission was not received until after the report was issued, while much of that received before June 1, 1920, could not be compiled in time for use in the report.

There were four schedules, one covering the financial features of the companies, another covering data on the production of crude petroleum, the third was addressed to refiners of petroleum products, and the fourth to jobbers and marketers.

Since the publication of the report above mentioned, the information secured from the schedules, which were sufficiently complete, has been compiled for presentation in this chapter. All of the information presented in this chapter was secured from reports submitted by the companies, and it was not verified by the Commission.

Section 2. Production of crude petroleum.

SCOPE OF INFORMATION.—It is estimated that there are 16,000 producers of crude petroleum in the United States. Many of this number have very small production and do not keep adequate records of their operations, hence the crude petroleum producers' schedules were only sent out to a comparatively small percentage of the producing companies. The companies selected were all quite large producers, of which only 82 submitted reports which contained information complete enough for tabulation. The information secured is not complete enough to be considered representative of the entire crude petroleum producing business, because it does not show the situation of the small producers. In addition to the 82 crude-petroleum producing companies, which submitted schedules, 138 refining companies, and certain other large companies, furnished information as to the quantity produced. These reports showed a total production of 239,038,000 barrels of crude petroleum for 1919, which is 63.3 per cent of the total of 377,719,000 [1] reported by the United States Geological Survey.

PRODUCTION BY LARGE INTERESTS.—A large proportion of the crude petroleum production of the United States is produced by a comparatively few large companies. Of the total of 239,038,000 barrels shown above, 224,190,000 barrels were produced by companies which, with their subsidiary or affiliated producing companies,

[1] Preliminary estimates of the U. S. Geological Survey.

had a production in excess of 1,000,000 barrels each in 1919, leaving only 14,848,000 barrels produced by the smaller companies covered. There were undoubtedly some other companies not reporting which produced more than 1,000,000 barrels in 1919, but practically all the principal producers are included.

Table 84 shows the number of companies having a production of more than 1,000,000 barrels in 1919, the total quantity produced by them, for Standard Oil and independent producers separately, and the average production per company for California and the territory east of the Rocky Mountains:

TABLE 84.—*Production of crude petroleum by Standard Oil and independent companies producing 1,000,000 barrels or over in 1919.*

Group.	Number of companies.	Production.	Average per company.
		Barrels.	*Barrels.*
Standard Oil:			
East of Rocky Mountains	8	55,011,862	6,876,483
California	1	25,484,984	25,484,984
Total	9	80,496,846	8,944,094
Independents:			
East of Rocky Mountains	16	96,862,244	6,053,890
California	7	46,830,832	6,690,119
Total	23	143,693,076	6,247,525
Total:			
East of Rocky Mountains	24	151,874,106	6,328,088
California	8	72,315,816	9,039,477
Total	32	224,189,922	7,005,935

As already stated, the marketed crude petroleum production for the United States in 1919, as reported by the United States Geological Survey, was 377,719,000 barrels. In 1919, 32 companies and subsidiaries produced 59.4 per cent of that total; members of the Standard Oil group contributed 21.3 per cent, and independent producing companies 38.1 per cent. Many of these companies are so closely related that they really represent but 20 different interests.

The total marketed production east of the Rocky Mountains in 1919, as reported by the United States Geological Survey, was 276,155,000 barrels. Of this total, 151,874,000 barrels, or 55 per cent, was produced by 24 companies, 8 of which belonged to the Standard Oil group and produced 19.9 per cent of the total, while 16 large independent producers produced 35.1 per cent of the total in this section. The total production in California during 1919 was 101,564,000 barrels, and 72,316,000 barrels, or 71 per cent, was produced by 8 companies.

From the above it appears that the production is more concentrated in California than in the territory east of the Rocky Mountains, excepting in the case of particular fields such as the Wyoming oil fields,[2] and that the large independents control a greater production than members of the Standard Oil group.

[2] Report of the Federal Trade Commission on The Petroleum Industry of Wyoming.

The largest production reported for a single company was for a member of the Standard Oil group in California and the second largest was for an independent company in the Mid-Continent Field; the production of the former was equal to 6.7 per cent of the total for the United States and of the latter 5.7 per cent. Reports were obtained from nine producing interests belonging to the Standard Oil group, viz, the South Penn Oil Co., the Ohio Oil Co., the Carter Oil Co., the Prairie Oil & Gas Co., the Cullinan Cos., the Magnolia Petroleum Co., the Standard Oil Co. of Louisiana, the Humble Oil & Refining Co., and the Standard Oil Co. (California). The average production per company for the large Standard producers named above was 8,944,094 barrels and for the large independents 6,247,525 barrels; while the averages east of the Rocky Mountains were 6,876,483 for members of the Standard group and 6,053,890 for the large independents.

The ability of the Standard group to secure necessary supplies of crude petroleum has depended more on its extensive control of pipe-line facilities than on direct control of production.[3] Taking only those companies which are recognized as being Standard companies and excluding those in which they have less than a 50 per cent interest, the Standard Oil group had a total production of 80,497,000 barrels, or about 21 per cent of the total marketed crude petroleum production of the United States in 1919. This figure is considerably larger than the figure reported to Congress on June 1, 1920, due to the inclusion of additional data and to a revision of the figures. The totals shown above represent practically the entire crude-petroleum production of the Standard Oil companies, as the production of companies belonging to this group which are not reported is so small as to be practically negligible. During 1920 the Standard Oil Co. (Indiana) acquired a 33 per cent interest in the Midwest Refining Co. This latter company has a large proportion of the crude-petroleum production in the Wyoming oil fields.

The refining operations of these two companies at Casper, Wyo., are so closely associated that this acquisition will give practical control to the Standard Oil Co. (Indiana). The Midwest Refining Co.'s production, that of its subsidiaries, and that secured through contracts and working agreements, was 8,292,588 barrels, while other Midwest interests produced 498,239 barrels. This production was all in the State of Wyoming. If this quantity were added to that of the Standard group, it would give this group a total of 88,789,434 barrels, or 23.5 per cent for the entire country. Excluding the California field, the crude-petroleum production for the Standard group in 1919 for the fields east of the Rocky Mountains was 55,012,000 barrels, or about 19.9 per cent of the total marketed crude petroleum production for those fields, while if the crude petroleum production of the Midwest Refining Co. is included this total would be increased to about 63,304,000 barrels, or 22.9 per cent.

A further study of the operations of large crude petroleum producers shows that most of the 32 companies, with a total production of 224,190,000 barrels in 1919, were either refiners of crude oil or were practically identified with them by the fact that the majority of the capital stock was held by the same stockholders. The production of

[3] In 1919 the Standard Oil group controlled about 68 per cent of the total trunk pipe line mileage in the United States.

companies who are themselves refiners, or thus integrated with refiners, amounted to over 210,000,000 barrels in 1919. It is thus seen that a considerable integration of the producing and refining phases of the industry has developed.

The distribution of the production of the above companies by the character of their operations is shown in Table 85.

TABLE 85.—*Crude petroleum production of large producing companies grouped according to the degree of integration, in barrels of 42 gallons, 1919.*

Group and character of business.	Number of companies.	Quantity.	Percentage of total production for United States.
		Barrels.	*Per cent.*
Standard Oil:			
Producers	4	32,108,579	8.5
Producers and refiners	1	1,430,178	.4
Producers, refiners, and marketers	4	46,958,089	12.4
Total	9	80,496,846	21.3
Independents:			
Producers	5	25,085,407	6.7
Producers and refiners	7	31,965,300	8.4
Producers, refiners, and marketers	11	86,642,369	23.0
Total	23	143,693,076	38.1
Total:			
Producers	9	57,193,986	15.2
Producers and refiners	8	33,395,478	8.8
Producers, refiners, and marketers	15	133,600,458	35.4
Total	32	224,189,922	59.4

During 1919 the companies reporting a production of over 1,000,000 barrels each engaged solely in producing crude petroleum produced 15.2 per cent of the total quantity marketed in the United States, companies engaged in producing and refining only produced 8.8 per cent, while the highly integrated companies which were engaged in all branches of the oil business from production of the crude to wholesale and retail distribution of refined products produced 35.4 per cent. The Standard group of companies engaged in crude petroleum production only showed a higher percentage of the total than independents, their respective percentages being 8.5 and 6.7 per cent of the total marketed in the United States for the year.

Independent companies engaged in producing crude petroleum and in refining it had 8.4 per cent of the total marketed, while similar Standard companies produced only four-tenths of 1 per cent. The acquisition of an interest in the Midwest Refining Co. by the Standard Oil Co. (Indiana) during 1920 will materially increase the quantity of crude petroleum produced by Standard companies engaged in producing and refining. If the crude petroleum production of the Midwest Refining Co., as shown in a preceding paragraph be included, the total quantity for Standard producing and marketing companies would be increased to 9,722,766 barrels and its proportion increased to about 2.6 per cent, while that for the large independents would be decreased.

The independent companies that are highly integrated and are engaged in all branches from the production of crude petroleum to the distribution of the refined products had almost twice as large a

production of crude petroleum in 1919 as the highly integrated Standard companies, the percentages of the marketed production being 23 per cent for independents and 12.4 per cent for members of the Standard group.

Section 3. Petroleum refining industry.

IMPORTANCE OF LARGE REFINERS.—The bulk of the crude petroleum refined in the United States is consumed by large refineries. In California, as already shown, 5 large companies refined 91 per cent of the total in 1919. In the same year in the Wyoming oil fields 1 large company refined almost 86 per cent of the total,[4] while 39 companies refined almost 85 per cent of all the crude petroleum consumed by the refineries in the entire country.

The present position of the Standard Oil group in the refining branch of the industry is of special interest. It has already been shown that in 1919 that interest produced 21.3 per cent of the marketed crude petroleum production of the United States. The following table shows the refining capacity and the proportion of crude petroleum consumed by the 14 recognized Standard Oil refining companies, by 25 large independent refining interests each of which consumed more than 1,000,000 barrels of crude oil, and for all other independent refiners for 1919:

TABLE 86.—*Daily capacity operated and consumption, Standard Oil and independent refiners, 1919.*[1]

Group.	Refining daily capacity.	Per cent.	Crude oil consumed in refineries.	Per cent.
	Barrels.		*Barrels.*	
Standard Oil	495,700	36.5	158,200,833	43.8
Large independents reporting to Commission	587,180	43.3	148,778,753	41.1
All other independents	273,475	20.2	54,540,567	15.1
Total	1,356,355	100.0	361,520,153	100.0

[1] In connection with the above figures it should be noted that they differ considerably from those shown in the report on The Advance in Price of Petroleum Products made on June 1, due to revised figures and more complete returns. (Report of Federal Trade Commission on The Advance in Price of Petroleum Products, p. 51.) The crude petroleum consumption of Standard Oil refineries instead of being 186,104,000 barrels as shown in that report is actually only 158,201,000 barrels according to reports made to the Commission, or 43.8 per cent of the total crude consumed instead of the 51.5 per cent. The total of 186,104,000 barrels included some oil reserves, which have been excluded in this chapter. The crude consumed by the large independents is much larger than is shown in the report of June 1 because the present tabulation covers the crude production of 25 large independent interests instead of 16.

The total daily capacity is that shown by the United States Bureau of Mines as having been operated at the end of 1919. The above table shows that the 14 Standard Oil companies had 36.5 per cent of the refining capacity of the country which was operated in 1919, but actually consumed 43.8 per cent of the total crude petroleum consumed as reported by the Bureau of Mines. The 25 large independents, on the other hand, had a larger proportion of the refining capacity than of the crude consumed—43.3 per cent as against 41.1 per cent. The other small independents also had a larger proportion of the refining capacity than of the crude consumed

The statistics of refining capacity and the total quantity of crude petroleum consumed were obtained from Bureau of Mines reports. The quantity of crude petroleum consumed by the large independent

[4] Report of Federal Trade Commission on The Petroleum Industry of Wyoming, p. 35.

refiners and by Standard Oil refineries were compiled from reports made to the Commission by the individual companies, while the capacity and quantity consumed by other independents is the difference between the total for the industry and the combined total shown for the Standard and large independent refiners.

There are 14 refining companies included in the Standard Oil group and 25 companies in the group of large independents. The Standard refineries had an average daily capacity of about 35,400 barrels and an average consumption of 11,300,060 barrels in 1919, while the 25 large independents had an average daily capacity of 23,487 barrels and an average consumption of 5,951,150 barrels in 1919.

The Standard refineries were operated at a larger percentage of their rated capacity than the 25 large independents. On the basis of rated capacity the Standard refineries were operated at 87 per cent of capacity and the large independents at 69 per cent.

REFINERY YIELDS.—The reports obtained by the Commission from companies operating 106 refining plants show considerable difference in the percentages of the principal petroleum products obtained from a barrel of crude petroleum. Yields from refineries consuming mixed crude—i. e., crude petroleum from several different fields—were eliminated. The number of refining plants, the quantity of crude petroleum consumed, and the percentages of yield for the principal petroleum products, as shown by reports to the Commission, from companies operating 106 refineries, by fields and States, is shown in Appendix Table 61.

The refineries designated as light products plants produced only the lighter refined products, such as gasoline and kerosene, and the residue is sold as gas and fuel oil. The lubricating plants produce these light products and in addition produce numerous grades of lubricants. The pressure stills are used to redistill the fuel and gas oil at extreme temperatures under heavy pressure. They are operated in connection with light products and lubricating plants and they secure additional gasoline from the fuel and gas oil.

As shown in the table, the percentages of yield represent a total of 106 plants consuming crude from practically every important crude petroleum producing State and field excepting California. The yields represent the operations under commercial conditions and do not show the possible yields that can be obtained from the different crudes. As already stated, refiners can vary their yields, within certain limits, to satisfy a relatively strong demand for certain products, and in order to realize a larger sales realization from their production.

The reports obtained by the Commission from refiners covered refinery consumption of 303,321,434 barrels, while Appendix Table 61 shows a consumption of 81,272,409 barrels. This difference is due to the exclusion of the operations of refining plants running several kinds of crude.

There is a wide range in the yields obtained by different plants in the same field, and for the same plant for different periods; this is largely due to the differences in the quality of the crude consumed in the refinery. For example, in Oklahoma a very much higher yield of gasoline is obtained by refiners consuming crude petroleum produced in the Cushing field than for plants operating on average Oklahoma crude, and in Wyoming the yield of gasoline from Elk Basin and Grass Creek crude is double that from the Big Muddy crude.

The most significant figures in this table are the yields for refineries consuming Pennsylvania crude (Pennsylvania and West Virginia combined), for refineries using Mid-Continent crude, and for those using the yields from Wyoming crude, all of which are representative, being based on a crude consumption of more than 5,000,000 barrels each.

YIELDS FROM APPALACHIAN CRUDE.—The yield from 23 lubricating plants consuming the Pennsylvania (Pennsylvania-West Virginia) grade of crude petroleum and consuming 5,761,000 barrels of crude showed a yield of 27.1 per cent of gasoline, 25.6 per cent of kerosene, 13.3 per cent of fuel and gas oil, 22.5 per cent of lubricating oil, and 6 per cent of miscellaneous products, leaving a loss of 5.5 per cent. The low yield of fuel and gas oil is due to the fact that there are no light products refineries in this section. The inclusion of other Appalachian crudes changes the yields for the Appalachian group slightly from these figures.

YIELDS FROM MID-CONTINENT CRUDE.—The yields from the different parts of the Mid-Continent Field differ considerably. The crude petroleum production of the Mid-Continent Field includes that of Kansas, Oklahoma, north Texas, Arkansas and north Louisiana. The production of this field is so large and its territory so extensive that representative yields can be secured from a number of sections of this field.

Kansas-Oklahoma.—The yields from 31 light products plants consuming Mid-Continent crude petroleum produced in Kansas and Oklahoma and refining 15,027,000 barrels of crude petroleum, showed a yield of 32.5 per cent of gasoline, 14.7 per cent of kerosene, 50 per cent of fuel and gas oil, and one-tenth of 1 per cent of miscellaneous products, leaving a loss of only 2.7 per cent. This yield of gasoline is much higher than the average for the entire production because the companies included are relatively small independent refiners who pay a premium over the posted price for the lighter crudes which yield more gasoline than is secured from the average grade. The inclusion of 21 light products plants consuming Healdton, Okla., north Texas, and north Louisiana crudes and consuming 9,242,000 barrels of crude petroleum reduces the average yield of gasoline by more than 3 per cent, but correspondingly increases the yields of the other products.

The yield from 11 lubricating plants operating on Mid-Continent crude petroleum and consuming 6,885,000 barrels of crude petroleum, showed a yield of 23.4 per cent of gasoline, 17.2 per cent of kerosene, 46.8 per cent of fuel and gas oil, 4.5 per cent of lubricating oil, and 2.9 per cent of miscellaneous products, leaving a refinery loss of 5.2 per cent. It is worthy of note that the yield of gasoline from these lubricating plants was 28 per cent less gasoline than from the 31 light products plants. This is not due to the character of the operations, but to the difference in the character of the crude. The same quality of crude petroleum may produce the same quantity of gasoline regardless of whether it is run through a light products plant or a lubricating plant, but a good crude petroleum for lubricating stock may frequently contain less gasoline than one that has little lubricating stock; however, some crudes rich in lubricants have a very high gasoline yield. Moreover, as already stated, the refineries operating the light products plants frequently purchase only such crude as produces a high yield of gasoline.

Comparing the yield of the Mid-Continent lubricating plants with the yield of 23 lubricating plants consuming Pennsylvania and West Virginia crude, it is significant as to the relative character of the crudes that the latter plants produce more lubricating oil, more gasoline, and more kerosene, but a much smaller yield of gas and fuel oil than the Mid-Continent lubricating plants. The Pennsylvania and West Virginia crude petroleum shows a greater yield of miscellaneous products, which is largely due to the larger yield of paraffin wax obtained from this crude petroleum.

As already stated, the term Mid-Continent Field is used to include Healdton, Okla., north Texas, and north Louisiana, as well as the Kansas and northern Oklahoma. The subject of yields from light-products plants should not be dismissed without studying the yields from some of these other light-products plants, as the quantity of crude refined by plants consuming the Healdton and north Texas crudes was large enough in 1919 to be representative.

Healdton.—Although the Healdton crude comes from the State of Oklahoma, it is a heavy crude and has a much lower gasoline content than most other Oklahoma crudes. The yield from three plants running 4,320,000 barrels of Healdton crude was 16.1 per cent of gasoline, or less than half the yield from the light-products plants consuming crude petroleum produced in Kansas and northern Oklahoma. The yield of kerosene was 22.4 per cent, or about one and one-half times that from the Kansas-Oklahoma crude while the fuel and gas oil was 56.9 per cent as compared with 50 per cent from the plants operating on crude produced in Kansas and northern Oklahoma.

North Texas.—The north Texas crude petroleum is similar in quality to the Kansas-Oklahoma crude and the yields of the different products by 15 plants running 4,035,000 barrels of this crude petroleum were practically the same as the yields from the 31 plants running 15,027,000 barrels of the Kansas-Oklahoma crude petroleum.

YIELDS FROM WYOMING CRUDE.—Refinery yields for light-products plants consuming 11,487,000 barrels of crude petroleum are shown in Appendix Table 61. This represents 90 per cent of the total quantity of crude petroleum refined in the entire Rocky Mountain Region. These plants recovered 26.9 per cent of gasoline, 10.3 per cent of kerosene, and 58.4 per cent of fuel and gas oil. The refinery loss was 4.3 per cent. Most of the fuel and gas oil produced by light-products plants in Wyoming is rerun through pressure stills.

YIELDS FROM PRESSURE STILLS.—Pressure still yields are not comparable with those from light-product or lubricating plants, as an increased yield of gasoline is obtained by breaking up the gas and fuel oil and recovering more gasoline. The yield from three plants operating pressure stills and consuming 29,495,000 barrels of Mid-Continent crude petroleum showed a yield of 46 per cent of gasoline, 15.8 per cent of kerosene, 15.4 per cent of fuel and gas oil, 6.1 per cent of lubricating oil, and 9.1 per cent of miscellaneous products, leaving a loss of 7.6 per cent. It will be observed that the yield of gasoline was double the yield from the lubricating plants, and the yield of lubricating oil was only slightly greater. There is a slight decrease in the yield of kerosene, but a very large decrease in the yield of fuel and gas oil. This large decrease in the yield of fuel and

gas oil is due to the fact that the pressure stills take the fuel and oil fractions and break them up into other products, the most imp tant of which is gasoline. The pressure stills show an increase nearly 46 per cent in the refinery loss.

Section 4. Earnings in the industry during 1919.

EARNINGS FROM PRODUCTION.—On June 1, 1920, when the C mission submitted its report to Congress on The Advance in Pr of Petroleum Products, only general statements could be made garding the profits for the year 1919. Since that time the sched received then or later have been tabulated and an anal has been made of the earnings for 82 crude petroleum produc companies that submitted complete reports covering the finan features of their business. While these 82 companies represent on small fraction of the total number of producers of crude petrole they produced about 16.5 per cent of the marketed production 1919, but as a large part of the crude petroleum production is tha integrated companies, the proportion of the 82 companies con tutes a large part of that for the nonintegrated companies.

EARNINGS IN ENTIRE BUSINESS.—The rate of earnings on the en business of the 82 companies engaged solely in producing cr petroleum has been compiled on the basis of their aggregate investment. The net investment was determined by deduct such items as appreciation of property, trade-marks, good will, a current liabilities from the total assets as reported by the compan The earnings on the entire business were determined by adding b to the reported earnings the interest on funded and other debt, a income and excess profits taxes. The gross production, the net inve ment, including funded debt, the earnings, including interest on func debt, and the rate of earnings for the entire business for 82 crude pet leum producing companies, by groups, is shown in the following tab

TABLE 87.—*Rate of earnings in the entire business for producing companies, by gro 1919.*

Section of field.	Number of companies.	Gross production.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rat earni
		Barrels.			*Per c*
Appalachian:					
Pennsylvania and West Virginia	12	4,333,654	$47,036,038	$5,407,359	
Kentucky	3	100,849	11,057,497	185,363	
Total	15	4,434,503	58,093,535	5,592,722	
Central West:					
Ohio	2	143,503	758,662	168,656	
Illinois	2	10,233,602	88,956,441	15,993,238	
Total	4	10,377,105	89,715,103	16,161,894	
Mid-Continent:					
Kansas and Oklahoma	13	22,767,297	181,567,458	31,099,875	
Oklahoma	23	7,395,429	78,547,554	8,901,563	
North Texas	4	10,735,874	17,908,184	6,973,358	
Healdton, Okla	2	302,127	1,589,036	325,239	
Total	42	41,200,727	279,612,232	47,300,035	
Gulf Coast	7	1,253,161	3,172,694	674,092	
Wyoming	6	2,431,831	13,875,979	1,045,134	
California	8	2,464,360	13,381,000	818,627	
Grand total	82	62,161,687	457,850,543	71,592,504	

The above table shows that for 82 strictly producing companies producing 62,162,000 barrels of crude oil, the rate of earnings on their net investment for 1919 was only 15.6 per cent. The eight California producing companies with a production of 2,464,000 barrels showed the lowest rate of return for any group, 6.1 per cent on net investment. The highest rate of return for any group was shown by four companies in the Central West with a production of 10,377,000 barrels and a return of 18 per cent on net investment. The highly important Mid-Continent group with a production of 41,201,000 barrels, including a small quantity of Healdton crude, showed a return of 16.9 per cent. The lowest return, 1.7 per cent, was for the State of Kentucky, but as the production reported was only 101,000 barrels, the figure is not significant. The highest average rate of earnings for a single group is shown for four companies in north Texas whose average rate of earnings was 38.9 per cent. There was a large new production in northern Texas in 1919, which accounts for the high average in that section. The combined results for the Appalachian field with a production of 4,435,000 barrels was 9.6 per cent.

EARNINGS IN PETROLEUM BUSINESS.—The net investment for the 82 companies in the oil business was obtained by deducting outside investments and investments in affiliated and subsidiary companies from the net investment shown above. The earnings for the oil business were determined by deducting from the earnings, shown above, the income from outside investments and from affiliated and subsidiary companies.

The following table shows the net investment, earnings, and rate of earnings for the oil business for 82 crude petroleum producing companies, by groups, in 1919:

TABLE 88.—*Rate of earnings in the petroleum business for producing companies, by groups, 1919.*

Section or field.	Number of companies.	Gross production.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rate of earnings.
		Barrels.			*Per cent.*
Appalachian:					
Pennsylvania and West Virginia	12	4,333,654	$36,884,620	$5,135,676	13.9
Kentucky	3	100,849	6,899,225	185,363	2.7
Total	15	4,434,503	43,783,845	5,321,039	12.2
Central West:					
Ohio	2	143,503	758,662	168,656	22.2
Illinois	2	10,233,602	40,531,631	13,502,394	33.3
Total	4	10,377,105	41,290,293	13,671,050	33.1
Mid-Continent:					
Kansas and Oklahoma	13	22,767,297	168,194,320	28,121,395	16.7
Oklahoma	23	7,395,429	66,101,127	8,159,272	12.3
North Texas	4	10,735,874	15,642,803	6,716,454	42.9
Healdton, Okla.	2	302,127	1,217,787	252,592	20.7
Total	42	41,200,727	251,156,037	43,249,713	17.2
Gulf Coast	7	1,253,161	3,063,109	653,610	21.3
Wyoming	6	2,431,831	13,549,477	1,039,002	7.7
California	8	2,464,360	13,004,719	793,896	6.1
Grand total	82	62,161,687	365,847,480	64,728,310	17.7

The rates of earnings for the oil business were generally higher than for the entire business, but in four cases they were lower. The greatest difference was in the case of the two Illinois companies

which showed 18 per cent on the entire business and 33. cent on the oil business, while on the other hand two K companies which showed earnings of 3.1 per cent on the (business show a loss of four-tenths of 1 per cent on the oil bus These companies had a small production. For the entire 82 panies the rate of earnings for the entire business was 15.6 as pared with 17.7 for the oil business alone.

A great variation in the rate of earnings is shown by groupin 82 crude petroleum producing companies according to the pr bleness of their oil producing operations in 1919. In the foll table these 82 companies have been placed in five groups as fol Group 1 includes the crude petroleum producing companies sh a loss on their net investment; group 2 is made up of comp earning less than 10 per cent; group 3 covers crude petroleum ducers earning from 10 to 20 per cent; group 4 comprises comp earning from 20 to 30 per cent; while group 5 consists of ope earning in excess of 30 per cent.

Table 89 shows the number of companies in each group, the production per group, the average gross production per com the proportion of production included in each group, the net in ment, the earnings, and the rate of earnings for each group, in

TABLE 89.—*Rate of earnings in the petroleum business for producing compan profit groups, 1919.*

Group.	Percentage of profit.	Number of companies.	Gross production.			Net investment (including funded debt).			Earnings including interest on funded debt.
			Total.	Average per company.	Proportion of total.	Total.	Average per company.	Proportion of total.	
			Barrels.	*Barrels.*	*Per ct.*			*Per ct.*	
1.....	Loss.....	14	1,638,302	117,022	2.6	$13,088,383	$934,885	3.6	[1] $362,18
2.....	Less than 10.	28	13,935,694	497,703	22.5	104,881,734	3,745,776	28.7	6,843,96
3.....	10 to 20.....	17	10,728,783	631,105	17.2	80,429,220	4,731,131	22.0	11,304,51
4.....	20 to 30.....	9	12,683,196	1,409,244	20.4	112,060,117	12,451,124	30.6	24,117,15
5.....	Over 30.....	14	23,175,712	1,655,408	37.3	55,388,026	3,956,288	15.1	22,824,86
	Total.	82	62,161,687	758,069	100.0	365,847,480	4,461,565	100.0	64,728,31

[1] Loss.

According to the reports submitted by the companies, almo per cent of the net investment in the oil business for the 82 c petroleum producing companies, earned from 20 to 30 per ce 1919, almost 29 per cent earned less than 10 per cent, 22 per earned from 10 to 20 per cent, while 15 per cent earned in exc 30 per cent.

Fourteen crude petroleum companies out of the 82 show a lo 1919 which averaged 2.8 per cent on their net investment in tl business. These 14 companies produced 2.6 per cent of the qua of crude petroleum produced by the 82 companies and had 3. cent of the net investment. The largest number of companie are in group 2, which show an average of 6.5 per cent of profit o net investment. This group produced 22.5 per cent of the (petroleum and had 28.7 per cent of the net investment. The group including 17 companies also shows a larger proportion o net investment than of the production. The average rate of ings for this group was 14.1 per cent, their net investment 2

cent of the total, while their proportion of the production was 17.2 per cent. Group 4, which shows an average rate of earnings of 21.5 per cent, had 20.4 per cent of the quantity of crude petroleum produced and 30.6 per cent of the net investment; while group 5, which shows an average rate of earnings of 41.2 per cent produced 37.3 per cent of the total production, but had less than half that percentage of the aggregate net investment.

The average investment per company ranged from $934,885 for group 1 to $12,451,124 for group 4, while the average net investment for group 5 was only slightly larger than that for group 2. The average production per company ranged from 117,022 barrels for group 1, which lost money, to 1,655,408 barrels for group 5, which showed the highest average rate of earnings, 41.2 per cent.

As already stated, most of the crude-petroleum producing companies having an annual production of over 1,000,000 barrels each submitted complete reports to the Commission. Hence, the results shown above include companies having an average annual production much in excess of the average for the industry. The results shown in the above table, which are corroborated by those shown for California for the period 1914 to June 30, 1919, indicate that probably many small crude petroleum producers showed a loss for 1919, but that companies producing the great bulk of the production obtained substantial profits.

The results for the 42 producing companies in the Mid-Continent Field grouped as above is shown in the following table:

TABLE 90.—*Rate of earnings in the petroleum business for producing companies operating in the Mid-Continent field, by profit groups, 1919.*

Group.	Percentage of profit.	Number of companies.	Gross production.			Net investment (including funded debt).			Earnings, including interest on funded debt.	Average rate of earnings.
			Total.	Average per company.	Proportion of total.	Total.	Average per company.	Proportion of total.		
			Barrels.	*Barrels.*	*Pr ct.*			*Pr ct.*		*Pr ct.*
1	Loss.....	6	294,154	49,026	0.7	$3,284,858	$547,476	1.3	[1] $114,770	[1] 3.4
2	Less than 10.	14	8,007,366	571,955	19.4	54,309,555	3,879,254	21.6	2,948,961	5.4
3	10 to 20.....	9	9,311,462	1,034,617	22.6	72,867,978	8,096,442	29.0	10,369,748	14.2
4	20 to 30.....	5	12,066,972	2,413,396	29.3	108,767,796	21,753,559	43.3	23,214,237	21.3
5	Over 30.....	8	11,520,773	1,440,097	28.0	11,925,850	1,490,731	4.8	6,831,537	57.3
	Total....	42	41,200,727	980,970	100.0	251,156,037	5,979,906	100.0	43,249,713	17.2

[1] Loss.

Over 43 per cent of the net investment for crude-petroleum producing companies, shown in the above table, earned from 20 to 30 per cent in 1919; 29 per cent earned from 10 to 20 per cent; and 21.6 per cent less than 10 per cent, while 1.3 per cent showed an average loss of 3.4 per cent, and 4.8 per cent earned above 30 per cent, with an average rate of earnings of 57.3 per cent.

The six companies showing a loss had a small average production of only 49,026 barrels. This group had 0.7 per cent of the gross production and almost double that percentage of the aggregate net investment. The 14 companies in group 2, with an average rate of earnings of 5.4 per cent, produced 19.4 per cent of the aggregate production and had 21.6 per cent of the net investment; group 3 earned 14.2 per cent, produced 22.6 per cent of the production and had 29 per cent

of the investment; group 4 had an average rate of earnings of 21.3 per cent, produced 29.3 per cent of the total quantity, and had 43.3 per cent of the net investment. This group includes large companies having an average annual production of 2,413,396 barrels and an average net investment of $21,753,559. The fifth group shows very large average earnings, 57.3 per cent. While this group has only 4.8 of the net investment it produced 28 per cent of the aggregate production. The average per company investment of this group is much lower than that of any other group showing a profit.

EARNINGS FROM REFINING BUSINESS.—Complete schedules were received from 138 refining companies which show their investment and earnings for 1919. These have been classified into four groups: Eastern, Middle West, Rocky Mountain, and Pacific Coast, according to the location of the refinery. The Eastern group includes refineries in the States of New Jersey, New York, Pennsylvania, and West Virginia; the Middle West group those in the States of Illinois, Indiana, Kansas, Kentucky, Louisiana, Missouri, Ohio, Oklahoma, and Texas. The Rocky Mountain group consists of refineries in Colorado, Utah, and Wyoming, while the Pacific Coast group covers the State of California. These refiners consumed about 303,321,000 barrels of crude petroleum in 1919, or 84 per cent of the total refined in the United States, as reported by the United States Bureau of Mines.

EARNINGS IN ENTIRE BUSINESS.—The rate of earnings has been computed on the net investment for the entire business of the 138 refining companies who submitted sufficient information regarding their investment and earnings. Table 91 shows the quantity of crude consumed, the quantity of crude produced by the same companies or closely affiliated companies, the refining capacity as reported by the companies, and the net investment and rate of earnings on the entire business for the 138 companies, by groups:

TABLE 91.—*Rate of earnings in the entire business for refining companies, by groups, in 1919.*

Section and State.	Number of companies.	Crude consumed.	Crude produced.	Refining capacity.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rate of earnings.
Eastern:		*Barrels.*	*Barrels.*	*Barrels.*			*Per ct.*
New York and New Jersey	3	55,128,677	.....	127,700	$694,095,853	$123,217,853	17.8
Pennsylvania and West Virginia	36	27,065,372	1,859,287	92,187	126,388,069	23,402,644	18.5
Total	39	82,194,049	1,859,287	219,887	820,483,922	146,620,497	17.9
Middle West:							
Illinois	6	7,877,085	3,091,915	25,480	37,482,312	3,992,960	10.7
Indiana	3	24,944,995	98,615	95,900	174,478,344	36,823,016	21.1
Kansas and Missouri	12	8,310,255	1,058,104	35,925	36,668,302	4,347,110	11.9
Louisiana	3	16,946,636	2,160,050	44,100	55,572,703	13,128,546	23.6
Ohio and Kentucky	7	6,386,395	51,948	21,850	43,395,627	13,259,907	30.6
Oklahoma	28	26,796,536	7,442,179	142,350	168,157,357	10,836,963	6.4
Texas	14	45,357,522	37,836,693	141,200	318,531,925	37,137,836	11.7
Total	73	136,619,424	51,739,504	506,855	834,286,570	119,526,338	14.3
Rocky Mountain:							
Colorado and Utah	4	1,160,963	92,188	5,575	7,034,928	926,761	13.2
Wyoming	3	11,487,491	9,403,503	52,250	52,852,379	15,597,124	29.5
Total	7	12,648,454	9,495,691	57,825	59,887,307	16,523,885	27.6
Pacific coast:							
California	19	71,859,507	53,126,812	279,360	373,624,971	67,148,315	18.0
Grand total	138	303,321,434	116,221,294	1,063,927	2,088,282,770	349,819,035	16.8

As already stated, the above table shows a crude petroleum consumption of 303,321,000 barrels as compared with a total consumption for the country in 1919, as reported to the Bureau of Mines, of 361,520,000 barrels or nearly 84 per cent. These same companies, or closely affiliated companies produced 116,211,294 barrels or 38.3 per cent of their crude petroleum consumption. These 138 companies had a daily refining capacity of 1,064,000 barrels or 79 per cent of the country's total refining capacity of 1,356,000 barrels daily, which was operated in 1919, as reported by the United States Bureau of Mines.[5] As these plants operated 79 per cent of the total capacity in operation in 1919 and consumed 84 per cent of the crude petroleum refined, it is evident that they were operated at a larger percentage of their rated capacity than were the refineries not covered in this report.

The 138 companies combined show a total net investment, including funded debt, of $2,088,283,000 and total earnings (after adding back interest on the funded debt) of $349,819,000, or 16.8 per cent on net investment.

The Middle West group is the largest group, but shows the lowest return on investment, 14.3 per cent on net investment. This group consumed 45 per cent of the total quantity of crude petroleum refined by the 138 companies and had almost 40 per cent of the net investment. The Rocky Mountain group shows the highest rate of earnings, 27.6 per cent. The rate of earnings for the Eastern group and the California companies are 17.9 and 18 per cent, respectively.

The lowest return for any division was the State of Oklahoma, in the Middle West group. Reports from 28 independent refiners showed a return on net investment of only 6.4 per cent. This tends to bear out the contention of the independent Mid-Continent refiners that they were making very little profit in 1919, and it is further supported by the fact that the profits in the other divisions of the Mid-Continent Field, Kansas and Texas, also show low rates of earnings.

The highest rate of earnings is shown for Ohio and Kentucky refineries, which include seven companies, and have a return of 30.6 per cent. The refineries in Wyoming show the next largest average rate of earnings, 29.5 per cent.

EARNINGS IN DOMESTIC PETROLEUM BUSINESS.—The net investment in the domestic oil business was determined by deducting all outside investments and investments in subsidiary and affiliated companies from the net investment for the entire business, while the income from such outside sources was deducted from the earnings on the entire business to obtain the earnings in the oil business. The following table shows the net investment, the earnings, and rate of earnings in the oil business for 138 petroleum refiners in 1919.

[5] Total daily refining capacity at end of 1919 was 1,530,565 barrels.

TABLE 92.—*Rate of earnings in the domestic petroleum business for refining companies by groups, in 1919.*

Section and State.	Number of companies.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rate of earnings
				Per cent
Eastern:				
New York and New Jersey	3	$350,316,241	$92,502,100	26.
Pennsylvania and West Virginia	36	106,285,550	22,553,272	21.
Total	39	456,601,791	115,055,372	25.
Middle West:				
Illinois	6	26,594,801	3,888,551	14.6
Indiana	3	153,020,376	36,093,115	23.6
Kansas and Missouri	12	23,514,719	4,154,013	17.7
Louisiana	3	53,737,333	13,073,071	24.3
Ohio and Kentucky	7	34,237,911	12,775,467	37.3
Oklahoma	28	141,137,746	8,890,175	6.3
Texas	14	270,745,972	31,231,443	11.5
Total	73	702,988,858	110,105,835	15.7
Rocky Mountain:				
Colorado and Utah	4	6,817,068	918,288	13.5
Wyoming	3	41,223,049	14,454,591	35.1
Total	7	48,040,117	15,372,879	32.0
Pacific Coast:				
California	19	318,045,947	64,756,679	20.4
Grand total	138	1,525,676,713	305,290,765	20.0

The total net investment in the domestic oil business for the 138 companies was $1,525,677,000, or $562,606,000 less than for the entire business of these companies, while the earnings from the oil business were $305,291,000, or only $44,528,000 less than the total earnings. The largest deduction on account of investment and earnings from outside investments occurred in the case of the Eastern group of refiners located on the Atlantic seaboard; the deductions for outside investment for these companies was $363,882,000 and that for earnings from such outside investments $31,565,000. This increased their rate of earnings from 17.9 for the entire business to 25.2 for the oil business. The Oklahoma refiners show a slightly smaller yield from the oil business than from their entire business. Their rate of earnings for the oil business was 6.3 per cent and for the entire business 6.4 per cent. The rate of earnings from the oil business for all companies reporting was considerably higher than for the entire business, 20 per cent for the former as compared with 16.8 per cent for the entire business.

The highest rate of earnings for the domestic oil business only is shown for the refineries in the Rocky Mountain Region. The average rate of earnings for seven companies was 32 per cent in 1919. Four companies in Colorado and Utah earned 13.5 per cent, while the three companies in Wyoming earned about 35 per cent. The Middle West group shows the lowest average rate of earnings, 15.7 per cent. There was a wide variation for the different States; 28 Oklahoma owners earned only 6.3 per cent, while 7 companies in Ohio and Kentucky earned 37.3 per cent.

The rate of earnings for the 138 refiners varied greatly in 1919. In order to show this variation a further analysis of their operations

has been made, and the companies have been placed in seven different groups according to the profitableness or unprofitableness of their operations in the domestic oil business in 1919. These seven groups have been further subdivided to show the results for the Eastern, Middle West, including Rocky Mountain, and Pacific Coast sections. The seven groups are defined as follows: Group 1 includes companies showing a loss on their 1919 operations; group 2 embraces those earning less than 10 per cent; group 3 covers companies earning from 10 to 20 per cent; group 4 shows those earning from 20 to 30 per cent; while companies having profits of 30 per cent or over are in group 5. The following table shows the quantity of crude petroleum consumed, the proportion of the total consumed, the net investment, proportion of net investment, the earnings and rate of earnings on the net investment, by groups and subgroups, as defined above, during 1919:

TABLE 93.—*Rate of earnings in the petroleum business for refining companies, by profit groups, 1919.*

Group.	Percentage of profit.	Number of companies.	Crude consumed.			Net investment (including funded debt).			Earnings (including interest on funded debt).	Rate of earnings.
			Total.	Average per company.	Proportion of total.	Total.	Average per company.	Proportion of total.		
			Barrels.	*Barrels.*	*Per ct.*			*Per ct.*		*Per ct.*
1	Loss	28	9,059,741	323,562	3.0	$28,654,470	$1,023,373	1.9	[1] $2,438,629	[1] 8.5
2	Less than 10.	39	49,109,788	1,259,225	16.2	284,872,231	7,304,416	18.7	16,847,393	5.9
3	10 to 20	26	71,221,055	2,739,271	23.5	390,559,945	15,021,536	25.6	53,444,606	13.7
4	20 to 30	17	105,574,739	6,210,279	34.8	481,855,050	28,344,415	31.6	118,844,812	24.7
5	30 and over	28	68,356,111	2,441,290	22.5	339,735,017	12,133,394	22.2	118,592,583	34.9
	Total	138	303,321,434	2,197,981	100.0	1,525,676,713	11,055,628	100.0	305,290,765	20.0

[1] Loss.

The above table shows that 28 companies, or one-fifth of the total number, lost money, but as they had only 3 per cent of the crude consumed and 1.9 per cent of the investment of all companies reporting, they were not an important factor in the situation. The largest group numerically was the one which earned less than 10 per cent. It was composed of 39 companies with 16.2 per cent of the crude consumed and 18.7 per cent of the investment, showing a return of 5.9 per cent. The most important group from the standpoint of consumption and investment was the group that made from 20 to 30 per cent. Although composed of only 17 companies, yet it had 34.8 per cent of the crude consumed and 31.6 per cent of the investment, showing an average profit of 24.7 per cent. Notwithstanding the fact that this group showed such a high return and that there were 28 companies showing a return of over 30 per cent, all groups combined showed a return of 20 per cent on investment.

EARNINGS IN DOMESTIC OIL BUSINESS GROUPED ACCORDING TO INVESTMENT.—The refining companies reporting to the Commission cover a wide range in size; 77 of the 138 companies have a net investment in the domestic petroleum business of less than $1,000,000 per

company, while 5 show an investment of $100,000,000 or over each. The following table shows the 138 companies grouped according to the size of their net investment:

TABLE 94.—*Rate of earnings in the domestic petroleum business, by investment groups, 1919.*

Group.	Range of investment.	Number of companies.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rate of earnings.
					Per cent.
1	$100,000,000 and over	5	$722,022,646	$177,580,952	24.6
2	$25,000,000 to $100,000,000	10	493,385,421	79,221,458	16.1
3	$5,000,000 to $25,000,000	15	217,052,162	33,639,067	15.5
4	$1,000,000 to $5,000,000	31	65,225,071	10,018,501	15.4
5	Under $1,000,000	77	27,991,413	4,830,787	17.3
	Total	138	1,525,676,713	305,290,765	20.0

The five groups shown in the above table have a very wide range in the average per company net investment in the domestic oil business; companies in group 1 average almost $144,405,000, while those in group 5 average only $363,525. In other words, the companies in group 1 have a net investment in the oil business almost 40 times as large as those in group 5. The rate of earnings for the five groups shows a range from 15.4 per cent to 24.6 per cent.

The largest rate of earnings is for group 1, which includes companies having an investment of over $100,000,000 per company. There are five companies in this group with an aggregate net investment in the oil business of $722,022,646 and aggregate earnings of $177,580,952. As already shown the average net investment per company is almost $144,405,000, the average earnings per company are $35,516,000, and the average rate of earnings 24.6 per cent. This group had 47 per cent of the net investment in the oil business and 58 per cent of the aggregate earnings.

The second largest rate of earnings is shown by group 5, which includes companies having the smallest per company net investment in the oil business. This group includes 77 companies with an average per company net investment of $363,525. This group shows an average rate of earnings of 17.3 per cent. Although this group includes 77 companies or 56 per cent of the total companies presented in the above table, it only covers about 18 per cent of the aggregate net investment and about 16 per cent of the total earnings.

The remaining groups show only a small difference in their average rate of earnings, which range from 15.4 per cent to 16.1 per cent. The groups having the larger net investment per company show a slightly higher rate of earnings than those with the smaller investment. Group 2 with an average of $49,338,500 net investment per company in the oil business earned 16 per cent; group 3 with an average of $14,470,100 earned 15.5 per cent, while group 4 which had an average investment of $2,104,000 per company earned 15.4 per cent. While the average per company net investment for group 2 was twenty-four times as large as group 4, its average rate of earnings was only 0.7 per cent greater.

EFFECT OF PRESSURE STILL OPERATION ON EARNINGS.—The larger yields of gasoline obtained by the refiners operating pressure stills have already been shown, and in the following a comparison is presented between the companies using pressure stills and those employing only ordinary refining methods.

TABLE 95.—*Comparison of rate of earnings in the domestic petroleum business, for refiners using pressure stills with those employing ordinary refining methods, by investment groups, 1919.*

Group.	Range of investment.	Refining method.	Number of companies.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rate of earnings.
						P. ct.
1	$100,000,000 and over	Pressure stills	3	$445,757,095	$121,108,651	27.2
		Ordinary method	2	276,265,551	56,472,301	20.4
	Total		5	722,022,646	177,580,952	24.6
2	$25,000,000 to $100,000,000	Pressure stills	4	233,134,779	49,911,708	21.4
		Ordinary method	6	260,250,642	29,309,750	11.3
	Total		10	493,385,421	79,221,458	16.1
3	$5,000,000 to $25,000,000	Pressure stills	6	83,778,429	18,944,482	22.6
		Ordinary method	9	133,273,733	14,694,585	11.0
	Total		15	217,052,162	33,639,067	15.5
4	$1,000,000 to $5,000,000	Pressure stills	4	14,345,054	5,786,128	40.3
		Ordinary method	27	50,880,017	4,232,373	8.3
	Total		31	65,225,071	10,018,501	15.4
5	Under $1,000,000	Ordinary method	77	27,991,413	4,830,787	17.3
	Total, all groups	Pressure stills	17	777,015,357	195,750,969	25.2
		Ordinary method	121	748,661,356	109,539,796	14.6
	Grand total		138	1,525,676,713	305,290,765	20.0

The rate of earnings for companies using pressure stills ranges from 1⅓ to almost 5 times as high, for each group, as the rate shown by companies employing only ordinary methods. The difference is greatest for group 4, which includes companies having a net investment ranging from $1,000,000 to $5,000,000. The average rate of earnings for the four companies using pressure stills was 40.3 per cent in 1919 as compared with an average of only 8.3 for companies employing ordinary methods of refining. The smallest difference is for group 1, which includes companies having a net investment in the oil business of $100,000,000 or over. The companies in this group are highly integrated, so that the larger refinery yields of gasoline secured from the pressure stills has less effect on their rate of earnings than for companies, such as are included in group 4, that are engaged almost exclusively in refining crude petroleum.

The Burton Process is the most important cracking process in use at the present time. It has been employed by Standard Oil refineries for a number of years, and in 1920 it was made available for independent companies. The proportion of gasoline and naphtha obtained by refiners using this process has been practically double that secured from the same crude by ordinary refining processes. For example, one refinery operating on Mid-Continent crude obtained a

yield of 59 per cent of gasoline for the first half of 1919 and 55 per cent for the last half. This gasoline averaged 58° Baumé the first period and 57° Baumé for the last half of 1919. In 1919 approximately 15 per cent of all the gasoline distilled in the United States was produced by the Burton Process.

EFFECT OF OWNERSHIP OF CRUDE PRODUCTION ON EARNINGS.—In the preceding paragraphs the 138 refining companies have been grouped according to the size of their net investment in the domestic oil business. In the succeeding discussion these companies have been placed on the basis of the quantity produced of the crude petroleum consumed which was produced by the refining company. Group 1 includes companies with less than 2 per cent production of crude petroleum, group 2 those with a production of less than 20 per cent of their refinery requirements, group 3 those with a production of from 20 to 50 per cent of their refinery consumption of crude petroleum, and group 4 those with a production of more than 50 per cent of their crude consumption. The results are shown in the following table:

TABLE 96.—*Rate of earnings in the domestic petroleum business, by companies, grouped according to the proportion of their crude petroleum consumption which they produced in 1919.*

Group.	Proportion of crude petroleum consumption produced.	Number of companies.	Net investment (including funded debt).	Earnings (including interest on funded debt).	Rate of earnings.
					Per cent.
1	None[1]	97	$668,126,386	$165,424,105	24.8
2	0 to 20 per cent	9	72,575,511	15,921,582	21.9
3	20 to 50 per cent	9	46,474,758	7,716,480	16.6
4	Over 50 per cent	23	738,500,058	116,228,598	15.7
	All groups	138	1,525,676,713	305,290,765	20.0

[1] A few companies had a negligible percentage of crude production.

The companies showing the highest rate of earnings in 1919 were those purchasing all of their supply of crude petroleum, while those producing less than 20 per cent of their requirements show the second largest returns. The companies having no crude petroleum production earned 24.8 per cent and those producing less than 20 per cent of their own requirements earned 21.9 per cent on their net investment in the oil business. The group producing more than 50 per cent of its crude supply shows smaller earnings than any other group.

APPENDIX.

EXHIBIT.

[From Annual Report of the Attorney General of the United States, 1920, pp. 111-112.]

SUITS AGAINST THE SOUTHERN PACIFIC RAILROAD CO. CONCERNING OIL LANDS.

These suits were brought to cancel patents issued to the Southern Pacific Co. and alleged to have been procured by fraud in that the company represented to the officials of the Land Department of the Government that the lands involved were nonmineral, whereas they were in fact, and were known by the company to be, valuable oil lands. The first case tried, known as the "Elk Hills case," involved some 6,000 acres, valued at many millions of dollars, located in the Elk Hills, Calif., within the limits of naval petroleum reserve No. 1, and was decided in the district court in favor of the United States. On appeal the circuit court of appeals reversed the decision below. Upon appeal by the Government from this decision the Supreme Court, on November 17, 1919, reversed the circuit court of appeals, finding the alleged fraud conclusively proven, and directed the entry of a decree canceling the patent as prayed thus restoring to the Government title to the very valuable oil lands.

The remaining six cases, involving approximately 150,000 acres, were consolidated for hearing and argued and submitted to the district court in April, 1918, and on August 3, 1919, decision was handed down adverse to the United States. From this decision the Government did not appeal, and, in view of the fact that it might be supposed that the six cases just referred to would be controlled by the decision in favor of the Government in the Elk Hills case, a word of explanation is deemed appropriate.

In the first of the six suits instituted, known as No. 46, civil, the Government contended that as a matter of law oil lands did not pass under grants to the company because mineral lands were expressly excepted from the grants and the patent contained a clause excepting mineral lands from its operation. Fraud in the procurement of the patent was also alleged, it being charged that the company had knowledge of the mineral character of the land at the date of patent. Before the case came to issue the Supreme Court, in Burke *v.* Southern Pacific Co. (234 U. S. 669), held that the mineral land exception in such patent was void, and that the patent was conclusive upon collateral attack, though subject to the right of the Government to attack it by direct suit if the land was known to be mineral when patent was issued. In the Burke case the court also held oil to be a mineral. The Government was therefore compelled to rely entirely in No. 46, civil, as it purposed doing in the Elk Hills case, upon its allegations of fraud, which it then had every reason to believe were well founded in both cases.

However, at the conclusion of the evidence in No. 46, civil, and the other cases consolidated therewith, it was found that there was an entire lack of proof of such facts and circumstances as impelled the court to find fraud in the Elk Hills case. On the contrary, there was indubitable evidence to the effect that the defendant company did not, at the time the patents were issued, believe that the lands were valuable for oil. In short, there was evidence supporting each and every finding of fact, and the court made no substantial ruling on the law adverse to any contention of the Government. Under these circumstances it seemed clear that an appeal would have been not only wasteful of time and money, but it might well be deemed frivolous.

APPENDIX TABLES.

TABLE 1.—*Imports, exports, and net imports of crude petroleum, in barrels of 42 gallons, 1913–1920.*[1]

Year.	Imports.	Exports.	Net imports.	Percentage of net imports to total consumption.
	Barrels.	*Barrels.*	*Barrels.*	*Per cent.*
1913	16,978,579	4,632,610	12,345,969	4.7
1914	16,913,121	2,969,894	13,943,227	5.3
1915	18,139,338	3,768,168	14,371,170	5.3
1916	20,796,865	4,095,902	16,700,963	5.2
1917	30,126,683	4,117,764	26,008,919	6.7
1918	37,735,641	4,900,723	32,834,918	8.0
1919	52,821,567	6,018,651	46,802,916	11.1
1920	106,175,289	8,757,092	97,418,197	18.5

[1] Compiled from Monthly Summary of Foreign Commerce of the United States, Bureau of Foreign and Domestic Commerce.

TABLE 2.—*Imports, exports, and net exports of refined petroleum products, in barrels of 42 gallons, for the United States, 1913–1920.*[2]

Year.	Exports.	Imports.	Net exports.
	Barrels.	*Barrels.*	*Barrels.*
1913	47,102,980	434,767	46,668,213
1914	51,056,079	335,615	50,720,464
1915	53,094,972	44,131	53,050,841
1916	59,367,438	447,854	58,919,584
1917	60,044,476	1,436,447	58,608,029
1918	60,599,729	1,227,833	59,371,896
1919	54,391,601	1,375,851	53,015,750
1920	67,110,196	2,646,496	64,463,700

[1] The quantities of paraffin wax reports in pounds have been converted to barrels on the basis of 6½ pounds to the gallon.

[2] Compiled from Monthly Summary of Foreign Commerce of the United States, Bureau of Foreign and Domestic Commerce.

TABLE 3.—*Marketed production of crude petroleum, in barrels of 42 gallons, by States, 1859–1920.*

[Statistics from United States Geological Survey, except for certain States in 1919, which are from State reports or trade journals.]

Year.	California.[a]	Oklahoma.	Pennsylvania and New York.	Texas.	Ohio.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
1859–1908	201,965,825	[1] 45,084,441	687,425,409	117,819,991	366,250,105
1908	44,854,737	45,798,765	10,584,453	11,206,464	10,858,797
1909	55,471,601	47,859,218	10,434,300	9,534,467	10,632,793
1910	73,010,560	52,028,718	9,848,500	8,899,266	9,916,370
1911	81,134,391	56,009,637	9,200,673	9,526,474	8,817,112
1912	[2] 87,272,593	51,427,071	8,712,076	11,735,057	[3] 8,969,007
1913	97,788,525	63,579,384	8,865,493	15,009,478	8,781,468
1914	99,775,327	73,631,724	9,109,309	20,068,184	8,536,352
1915	86,591,535	97,915,243	8,726,483	24,942,701	7,825,326
1916	90,951,936	107,071,715	8,466,481	27,644,605	7,744,511
1917	93,877,549	107,507,471	8,612,885	32,413,287	7,750,540
1918	97,531,997	103,347,070	8,216,655	38,750,031	7,285,005
1919	101,564,000	84,604,810	8,074,272	35,987,000	7,087,768
1920	105,668,000	105,725,000	8,360,400	96,000,000	7,412,000
Total to date	1,317,458,576	1,041,650,267	804,637,389	509,537,005	477,867,154

[a] Total differs slightly from Tables 9 and 11, which are Standard Oil Co. statistics.

[1] Production for 1905 and 1906 included in Kansas.

[2] Includes Alaska.

[3] Includes Michigan.

TABLE 3.—*Marketed production of crude petroleum, in barrels of 42 gallons, by States, 1859–1920*—Continued.

Year.	Illinois.	West Virginia.	Kansas.	Louisiana.	Indiana.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
1859–1908	28,866,683	185,039,718	[4] 42,357,150	27,413,511	90,127,511
1908	33,686,238	9,523,176	1,801,781	5,788,874	3,283,629
1909	30,898,339	10,745,092	1,263,764	3,059,531	2,296,086
1910	33,143,362	11,753,071	1,128,668	6,841,395	2,159,725
1911	31,317,038	9,795,464	1,278,819	10,720,420	1,695,289
1912	28,601,308	12,128,962	1,592,796	9,263,439	970,009
1913	23,893,899	11,567,299	2,375,029	12,498,828	956,095
1914	21,919,749	9,680,033	3,103,585	14,309,435	1,335,456
1915	19,041,695	9,264,798	2,823,487	18,191,539	875,758
1916	17,714,235	8,731,184	8,738,077	15,248,138	769,036
1917	15,776,860	8,379,285	36,536,125	11,392,201	759,432
1918	13,365,974	7,866,628	45,451,017	16,042,600	877,558
1919	12,436,000	7,357,608	31,292,190	15,575,000	929,880
1920	10,772,000	8,173,000	38,501,000	35,649,000	932,000
Total to date	321,433,380	310,005,318	218,243,488	201,993,911	107,967,464

Year.	Wyoming.	Kentucky and Tennessee.	Colorado.	Montana.	Other.	United States.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
1859–1908	[5] 85,785	5,276,578	8,874,285	.....	[6] 21,471	1,806,608,463
1908	[7] 17,775	[8] 727,767	379,653	.....	[6] 15,246	178,527,365
1909	[7] 20,056	[8] 639,016	310,861	.....	[6] 5,750	183,170,874
1910	[7] 115,430	[8] 468,774	239,794	.....	[6] 3,615	209,557,248
1911	[7] 186,695	[8] 472,458	226,926	.....	[6] 7,995	220,449,391
1912	1,572,306	[8] 484,368	206,052	.....	.....	222,935,044
1913	2,406,522	[8] 524,568	188,799	.....	[9] 10,843	248,446,230
1914	3,560,375	[8] 502,441	222,773	.....	[10] 7,792	265,762,525
1915	4,245,525	[8] 437,274	208,475	.....	[10] 14,265	281,104,104
1916	6,234,137	1,203,246	197,235	44,917	[10] 7,705	300,767,158
1917	8,978,680	3,100,356	121,231	99,399	[11] 10,300	335,315,601
1918	12,596,287	4,376,342	143,286	69,323	[11] 7,943	355,927,716
1919	[12] 13,379,000	9,226,472	150,000	55,000	.....	377,719,000
1920	17,071,000	8,692,600	110,000	336,000	.....	443,402,000
Total to date	70,469,573	36,132,260	11,579,370	604,639	112,925	5,429,692,719

[4] Includes Oklahoma in 1905 and 1906.
[5] Includes Utah in 1907.
[6] Michigan and Missouri.
[7] Includes Utah.
[8] No production recorded for Tennessee.
[9] Alaska, Michigan, Missouri, and New Mexico.
[10] Alaska, Michigan, and Missouri.
[11] Alaska and Michigan.
[12] State report shows 13,580,000.

TABLE 4.—*Proven acres per well and average barrels per acre, by fields, in California, 1914–1920.*

Field.	1914				1915			
	Proven acres Dec. 31.[1]	Producing wells Dec. 31.[1]	Acres per well.	Barrels per acre.	Proven acres Dec. 31.[1]	Producing wells Dec. 31.[1]	Acres per well.	Barrels per acre.
Kern River	7,650	1,385	5.5	919	7,650	1,684	4.5	1,050
McKittrick	1,345	251	5.4	2,841	1,345	276	4.9	2,641
Midway-Sunset	36,500	1,376	26.5	1,371	36,800	1,418	26.0	1,068
Lost Hills-Belridge	2,900	240	12.1	1,666	3,095	248	12.5	1,395
Coalinga	14,400	815	17.7	1,106	14,440	804	18.0	938
Santa Maria	7,890	235	33.6	545	7,900	237	33.3	574
Ventura and Newhall	4,150	442	9.4	233	4,190	444	9.4	247
Los Angeles and Salt Lake	2,700	687	3.9	928	2,700	691	3.9	782
Whittier-Fullerton	3,400	568	6.0	4,156	3,700	613	6.0	3,522
Summerland	230	102	2.3	242	230	112	2.1	230
Miscellaneous	200	5	40.0	137	200	5	40.0	137
Total	81,365	6,106	13.3	1,274	82,250	6,532	12.6	1,089

TABLE 4.—*Proven acres per well and average barrels per acre, by fields, in California, 1914–1920*—Continued.

Field.	1916				1917			
	Proven acres Dec.31.[1]	Producing wells Dec.31.[1]	Acres per well.	Barrels per acre.	Proven acres Dec.31.[1]	Producing wells Dec.31.[1]	Acres per well.	Barrels per acre.
Kern River	7,690	1,908	4.0	1,093	7,730	1,969	3.9	1,099
McKittrick	1,545	293	5.3	2,091	1,635	309	5.3	1,989
Midway-Sunset	39,404	1,710	23.0	988	40,204	1,997	20.1	909
Lost Hills-Belridge	3,731	350	10.7	1,301	4,476	485	9.2	1,406
Coalinga	14,611	949	15.4	984	14,771	1,038	14.2	1,079
Santa Maria	7,970	249	32.0	555	7,710	300	25.7	752
Ventura and Newhall	4,394	446	9.9	255	4,514	451	10.0	263
Los Angeles and Salt Lake	2,700	674	4.0	638	2,700	683	4.0	556
Whittier-Fullerton	4,075	637	6.4	3,602	4,575	704	6.5	3,968
Summerland	230	112	2.1	247	230	112	2.1	246
Miscellaneous	200	5	40.0	137	200	5	40.0	137
Total	86,550	7,333	11.8	1,061	88,745	8,053	11.0	1,096

Field	1918				1919			
	Proven acres Dec.31.[1]	Producing wells Dec.31.[1]	Acres per well.	Barrels per acre.	Proven acres Dec.31.[1]	Producing wells Dec.31.[1]	Acres per well.	Barrels per acre.
Kern River	7,755	1,996	3.9	1,021	7,774	2,067	3.8	973
McKittrick	1,645	333	4.9	1,854	1,670	341	4.9	1,683
Midway-Sunset	40,582	2,208	18.4	839	40,695	2,348	17.3	786
Lost Hills-Belridge	4,675	535	8.7	1,159	4,851	561	8.6	939
Coalinga	14,916	1,140	13.1	1,092	14,990	1,229	12.2	1,093
Santa Maria	7,998	343	23.3	893	8,254	378	21.8	731
Ventura and Newhall	4,904	456	10.8	283	4,961	504	9.8	361
Los Angeles and Salt Lake	2,700	664	4.1	518	2,700	665	4.1	497
Whittier-Fullerton	5,239	784	6.7	4,754	5,762	887	6.5	4,974
Summerland	230	142	1.6	237	230	142	1.6	233
Miscellaneous	200	5	40.0	137	200	5	40.0	137
Total	90,844	8,606	10.6	1,119	92,087	9,127	10.1	1,099

Field.	1920			
	Proven acres Dec. 31.[1]	Producing wells Dec. 31.[1]	Acres per well.	Barrels per acre.
Kern River	7,876	2,152	3.7	947
McKittrick	1,670	352	4.7	1,561
Midway-Sunset	41,333	2,509	16.5	917
Lost Hills-Belridge	5,026	591	8.5	824
Coalinga	15,060	1,293	11.6	1,027
Santa Maria	8,362	406	20.6	709
Ventura and Newhall	4,999	513	9.7	425
Los Angeles and Salt Lake	2,700	666	4.1	486
Whittier-Fullerton	6,381	990	6.4	4,497
Summerland	230	140	1.6	239
Miscellaneous	200	9	22.2	128
Total	93,837	9,621	9.8	1,127

[1] Statistics from Standard Oil Bulletin. The Standard Oil Co. (Calif.) explains the 1919 acreage as follows:

"The proven area of the California oil fields is shown as 92,087 acres, equivalent to 143.89 square miles. In determining the figures the boundary lines of the proven area are drawn approximately 250 feet outside producing wells. In case of outlying single wells the field is credited with about 15 acres. The figures therefore represent the actual proven area and give no consideration to territory that is generally regarded as proven but is not fully drilled. For instance, large areas of undrilled territory in the Buena Vista Hills, although regarded as proven, are not included in the tablulation. The proven acreage as shown is therefore low as compared with figures made by others."

TABLE 5.—*Proportion of oil wells, gas wells, and dry wells drilled in California and in the entire United States, 1907–1919.*

Year.	Section.	Oil wells.		Gas wells.		Dry wells.		Total.
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.
1907	California	296	96	2	1	11	3	309
	United States	15,521	79	415	2	3,631	19	19,567
1908	California	594	95	5	1	23	4	622
	United States	13,210	78	490	3	3,214	19	16,914
1909	California	578	90	7	1	60	9	645
	United States	13,875	76	1,055	6	3,404	18	18,334
1910	California	763	93	4	1	50	6	817
	United States	10,777	73	1,500	10	2,422	17	14,699
1911	California	970	89	8	1	104	10	1,082
	United States	9,825	71	1,588	12	2,363	17	13,776
1912	California	776	91	6	1	71	8	853
	United States	12,514	73	1,817	10	2,855	17	17,186
1913	California	789	91	9	1	67	8	865
	United States	19,101	75	2,216	8	4,282	17	25,599
1914	California	512	90	8	2	47	8	567
	United States	16,668	72	2,335	10	4,142	18	23,145
1915	California	272	91	8	2	20	7	300
	United States	9,154	65	2,030	14	2,981	21	14,165
1916	California	613	94	7	1	32	5	652
	United States	18,777	76	1,810	7	4,039	17	24,626
1917	California	686	92	10	1	48	7	744
	United States	16,590	71	1,976	8	4,851	21	23,417
1918	California	676	90	18	2	60	8	754
	United States	17,845	69	2,247	9	5,610	22	25,702
1919	California	547	90	10	2	51	8	608
	United States	21,226	73	2,087	7	5,807	20	29,120
	Total California	8,072	92	102	1	644	7	8,818
	Total United States	195,083	73	21,566	8	49,601	19	266,250

TABLE 6.—*Number and proportion of wells drilled in California, by companies reporting to the Commission, and the percentage drilled, by groups, 1914–1918.*

Year.	Total number for State.	Wells of companies reporting.		Reported wells by producing groups.							
				No. 1		No. 2		No. 3		No. 4	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
1914	567	238	42	150	63	45	19	31	13	12	5
1915	300	168	56	113	67	39	23	13	8	3	2
1916	652	435	67	343	79	37	9	37	8	18	4
1917	744	559	75	415	74	42	8	69	12	33	6
1918	754	517	69	373	72	73	14	59	12	12	2
Total	3,017	1,917	64	1,394	73	236	12	209	11	78	4

Group arrangement based upon the gross production in each year.
No. 1—Companies producing 1,000,000 barrels and over annually.
No. 2—Companies producing 250,000 to 1,000,000 barrels annually.
No. 3—Companies producing 50,000 to 250,000 barrels annually.
No. 4—Companies producing under 50,000 barrels annually.

TABLE 7.—*Physical properties of representative samples of California crude petroleum.*[1]

Field.	Specific gravity at 15° C.	Baumé degrees at 60° F.	Heating value per pound (B. t. u.).	Weight per gallon (pounds).	Flash point (open cup) °C.	Burning point (open cup) °C.	Viscosity at 20° C. (Engler scale).
Los Angeles City	0.9629	15.40	18,443	8.0227	107.0	145.0	272.5
Salt Lake	.9604	15.61	18,210	8.0018	46.0	89.0	274.3
Fullerton	.9207	22.26	18,790	7.6711	17.9	52.1	110.5
Whittier	.9386	19.20	18,808	7.8197	46.0	84.0	34.6
Newhall	.9245	21.93	18,845	7.7026	60.0	83.0	118.2
Santa Paula	.9022	25.32	18,834	7.5169	6.0	18.0	5.8
Lompoc	.9343	19.85	18,334	7.7845	−1.0	21.0	62.5
Santa Maria	.9053	24.68	18,720	7.5429	−2.0	20.0	19.9
Coalinga	.9385	19.26	18,558	7.8190	70.0	93.0	80.7
Midway	.9324	20.30	18,755	7.7498	54.0	83.0	91.7
Sunset	.9421	18.67	18,706	7.8496	47.0	79.0	120.5
Kern River	.9655	15.00	18,544	8.0414	102.0	128.0	690.0

[1] Bacon and Hamor, American Petroleum Industry, Vol. I, p. 131.

TABLE 8.—*Quantity and proportion of light and heavy crude petroleum produced in California, 1907–1919.*[1]

Year.	Light crude (18° Baumé and over).		Heavy crude (17.9° Baumé and under).		Total quantity (barrels).
	Barrels.	Per cent.	Barrels.	Per cent.	
1907	13,634,854	34	26,467,658	66	40,102,512
1908	17,390,425	36	30,916,312	64	48,306,737
1909	20,949,020	36	37,242,703	64	58,191,723
1910	34,963,906	45	42,733,662	55	77,697,568
1911	39,359,701	47	44,384,343	53	83,744,041
1912	48,640,197	51	41,434,242	46	90,074,439
1913	61,656,326	63	36,210,858	37	97,867,184
1914	71,500,350	69	32,123,345	31	103,623,695
1915	58,218,406	65	31,348,373	35	89,566,779
1916	59,684,535	65	32,137,827	35	91,822,362
1917	64,196,769	66	33,071,063	34	97,267,832
1918	68,097,373	67	33,540,497	33	101,637,870
1919	68,830,813	68	32,390,971	32	101,221,784

[1] Furnished by the Standard Oil Co. (California).

LE 9.—*Gross production of crude petroleum, in barrels of 42 gallons, in California, by fields, 1876–1920.*

Year.	Total.		Ventura County and Newhall.		Los Angeles and Salt Lake.		Summerland.	
	Barrels.	Per centage of maximum annual production.	Barrels.	Per centage of maximum annual production.	Barrels.	Per centage of maximum annual production.	Barrels.	Per centage of maximum annual production.
to year								
.....	175,000	(1)	175,000	8	.....	.....	.....	.....
.....	12,000	(1)	12,000	1	.....	.....	.....	.....
.....	13,000	(1)	13,000	1	.....	.....	.....	.....
.....	15,227	(1)	15,227	1	.....	.....	.....	.....
.....	19,858	(1)	19,858	1	.....	.....	.....	.....
.....	40,552	(1)	40,552	2	.....	.....	.....	.....
.....	99,862	(1)	99,862	5	.....	.....	.....	.....
.....	128,636	(1)	128,636	6	.....	.....	.....	.....
.....	142,857	(1)	142,857	7	.....	.....	.....	.....
.....	262,000	(1)	262,000	12	.....	.....	.....	.....
.....	325,000	(1)	325,000	15	.....	.....	.....	.....
.....	377,145	(1)	377,145	18	.....	.....	.....	.....
.....	678,572	1	678,572	32	.....	.....	.....	.....
.....	690,333	1	690,333	33	.....	.....	.....	.....
.....	303,220	(1)	303,220	14	.....	.....	.....	.....
.....	307,360	(1)	307,360	14	.....	.....	.....	.....
.....	323,600	(1)	323,600	15	.....	.....	.....	.....
.....	385,049	(1)	385,049	18	.....	.....	.....	.....
.....	470,179	(1)	470,179	22	.....	.....	.....	.....
.....	783,078	1	524,469	25	257,109	5	1,500	1
.....	1,245,339	1	476,490	22	751,945	15	16,904	8
.....	1,257,780	1	298,866	14	905,003	18	39,792	19
.....	1,911,569	2	368,282	17	1,327,011	26	130,136	52
.....	2,249,088	2	427,000	20	1,462,871	28	132,217	83
.....	2,677,875	3	496,200	23	1,409,356	27	208,370	100
.....	4,319,950	4	443,000	21	1,722,887	34	183,486	88
.....	7,710,315	7	472,057	22	2,304,432	45	203,616	98
.....	14,356,910	14	475,000	22	2,198,496	43	143,552	69
.....	24,334,481	23	682,185	32	793,765	15	131,125	63
.....	29,548,634	28	650,779	31	1,241,304	24	120,506	58
.....	34,298,041	32	476,898	22	2,226,768	43	96,871	46
.....	32,623,229	31	404,379	19	2,675,650	52	72,810	35
.....	40,102,512	38	435,584	21	3,372,465	66	69,060	33
.....	48,306,737	46	498,015	23	5,138,959	100	67,862	33
.....	58,191,723	55	516,628	24	4,350,898	65	66,338	32
.....	77,697,568	73	652,575	31	3,729,618	73	74,725	36
.....	83,744,044	79	661,785	31	3,223,661	63	71,255	34
.....	90,074,439	85	859,885	41	3,073,427	60	65,715	32
.....	97,867,184	93	1,022,052	48	2,898,846	56	62,406	30
.....	103,623,695	98	968,421	46	2,504,475	49	55,743	27
.....	89,566,779	85	1,036,305	49	2,110,133	41	53,000	25
.....	91,822,362	87	1,122,033	53	1,721,453	34	56,775	27
.....	97,267,832	92	1,186,407	56	1,501,799	29	56,570	27
.....	101,637,870	96	1,386,518	65	1,397,781	27	54,613	26
.....	101,221,784	96	1,792,465	84	1,341,415	26	53,680	26
.....	105,721,186	100	2,122,449	100	1,311,264	26	54,910	26
Total.....	1,348,931,454	.....	25,226,177	.....	56,952,791	.....	2,343,537	.....

s than one-half of 1 per cent.

TABLE 9.—*Gross production of crude petroleum, in barrels of 42 gallons, in California, by fields, 1876–1920*—Continued.

Year.	Coalinga.		Whittier-Fullerton.		McKittrick.	
	Barrels.	Percentage of maximum annual production.	Barrels.	Percentage of maximum annual production.	Barrels.	Percentage of maximum annual production.
1896	14,119	(1)				
1897	70,140	(1)	12,000	(1)		
1898	154,000	1	60,000	(1)	10,000	(1)
1899	439,372	2	108,077	(1)	16,000	(1)
1900	547,960	3	254,397	1	89,000	1
1901	525,433	3	302,652	1	430,450	7
1902	571,233	3	1,103,793	4	619,296	11
1903	2,138,058	11	2,305,613	8	1,353,206	23
1904	5,097,853	26	2,224,550	8	1,856,225	32
1905	8,882,125	45	2,118,312	7	1,373,030	24
1906	8,401,105	43	2,434,512	8	680,756	12
1907	8,996,268	46	3,294,206	11	2,415,840	12
1908	10,725,795	55	4,273,314	15	3,076,300	53
1909	15,406,619	79	5,157,252	18	5,807,360	100
1910	18,646,570	45	6,281,221	22	5,471,613	94
1911	18,311,251	44	7,081,165	25	5,477,532	94
1912	19,546,122	100	7,919,779	28	5,094,465	88
1913	18,604,626	95	10,657,053	37	4,496,842	77
1914	15,925,887	81	14,130,548	49	3,820,857	66
1915	13,548,159	69	13,030,549	45	3,552,801	61
1916	14,381,493	74	14,679,672	51	3,230,644	56
1917	15,938,543	62	18,155,440	63	3,252,544	56
1918	16,283,066	83	24,903,613	87	3,050,627	53
1919	16,385,610	84	28,657,683	100	2,810,848	43
1920	15,464,198	79	28,694,163	100	2,607,240	45
Total	245,005,605		197,839,564		60,583,476	

Year.	Kern River.		Sunset.		Midway.	
	Barrels.	Percentage of maximum annual production.	Barrels.	Percentage of maximum annual production.	Barrels.	Percentage of maximum annual production.
1900	826,775	5	12,500	(1)		
1901	3,278,840	18	188,600	2	4,235	(1)
1902	8,988,046	52	167,558	1	3,048	(1)
1903	16,342,099	95	352,565	3	27,305	(1)
1904	17,226,240	100	390,425	3	910	(1)
1905	15,253,845	89	419,212	3	18,530	(1)
1906	12,825,166	74	307,550	2	11,800	(1)
1907	12,346,014	72	704,805	8	149,944	(1)
1908	13,803,579	80	1,463,510	12	434,578	1
1909	14,508,242	84	1,999,701	16	2,234,455	6
1910	14,776,435	86	9,218,904	78	11,174,207	29
1911	14,078,890	82	5,559,069	44	21,584,602	58
1912	12,446,445	72	5,590,824	45	25,948,980	69
1913	9,980,940	58	5,984,651	48	33,040,129	88
1914	7,030,545	41	12,546,615	100	37,479,228	100
1915	8,034,974	47	6,006,607	48	33,311,486	89
1916	8,402,525	49	6,768,658	54	32,156,818	86
1917	8,495,610	49	7,072,333	56	29,487,812	79
1918	7,921,515	46	6,608,940	53	27,439,993	73
1919	7,563,025	44	5,589,885	49	26,414,067	70
1920	7,456,515	43	5,423,781	45	32,493,229	87
Total	221,586,265		82,376,693		313,415,356	

[1] Less than one-half of 1 per cent.

TABLE 9.—*Gross production of crude petroleum, in barrels of 42 gallons, in California, by fields, 1876–1920* [1]—Continued.

Year.	Santa Maria.		Lost Hills-Belridge.		Miscellaneous.	
	Barrels.	Percentage of maximum annual production.	Barrels.	Percentage of maximum annual production.	Barrels.	Percentage of maximum annual production.
1897					4,000	2
1898					3,000	1
1899					1,500	1
1900					248,945	100
1902	86,888	1				
1903	204,890	2			3,670	1
1904	700,450	8			39,392	16
1905	3,402,800	39			29,650	12
1906	4,799,411	55			10,090	4
1907	8,249,236	95			69,090	28
1908	8,699,350	100			125,475	50
1909	8,017,455	92			126,775	51
1910	7,607,830	87	4,900	[2]	58,970	24
1911	7,465,074	86	168,410	3	61,350	25
1912	6,801,966	78	2,680,961	43	45,870	18
1913	5,817,711	67	5,274,553	84	27,375	11
1914	4,303,080	49	4,830,921	77	27,375	11
1915	4,536,840	52	4,318,550	69	27,375	11
1916	4,422,410	51	4,852,431	77	27,450	11
1917	5,798,070	67	6,295,329	100	27,375	11
1918	7,143,750	82	5,420,079	86	27,375	11
1919	6,030,910	69	4,554,821	72	27,375	11
1920	5,928,060	68	4,139,767	66	25,610	10
Total	100,016,181		42,540,722		1,045,087	

[1] No production in 1901.

[2] Less than one-half of 1 per cent.

TABLE 10.—*Average daily production per well for the principal petroleum-producing States, 1918.*

State.	Number of wells Dec. 31.	Marketed production in barrels.	Average daily production per well.
Wyoming	931	12,596,287	37.07
California	8,968	97,531,997	29.80
Louisiana	2,193	16,042,600	20.04
Texas	7,134	38,750,031	14.88
Kansas	8,682	45,451,017	14.34
Oklahoma	37,720	103,347,070	7.51
Kentucky	3,630	4,376,342	3.30
Illinois	16,004	13,365,974	2.29
Indiana	1,803	877,558	1.33
West Virginia	16,369	7,866,628	1.32
Ohio	29,500	7,285,005	.68
Pennsylvania and New York	70,287	8,216,655	.32
Other States	154	220,552	3.92
United States	203,375	355,927,716	4.79

TABLE 11.—*Gross production of crude petroleum, in barrels of 42 gallons, by 7 large interests in California, 1914–1919.*

Company.	1919		1918		1917	
	Barrels.	Per cent.	Barrels.	Per cent.	Barrels.	Per cent.
Standard Oil Co. (California)	25,484,984	25.18	22,446,021	22.08	17,795,364	18.29
Associated-Southern Pacific interests	18,444,055	18.22	18,608,967	18.31	19,554,614	20.10
Union Oil Co. of California	8,705,447	8.60	8,271,084	8.14	7,430,153	7.64
Shell Co. of California	6,702,971	6.62	6,789,862	6.68	6,292,999	6.47
Doheny companies	5,836,799	5.77	4,194,464	4.13	3,312,497	3.41
Santa Fe Railway	3,754,299	3.71	3,392,455	3.34	3,351,776	3.45
General Petroleum Corporation	3,387,261	3.34	3,583,477	3.52	4,017,693	4.13
Total	72,315,816	71.44	67,286,330	66.20	61,755,096	63.49
Other companies reporting to Commission	6,987,712	6.90	14,397,647	14.17	14,118,037	14.51
Production of companies not reporting to Commission	21,918,256	21.66	19,953,893	19.63	21,394,699	22.00
Total production of California	101,221,784	100.00	101,637,870	100.00	97,267,832	100.00

Company.	1916		1915		1914	
	Barrels.	Per cent.	Barrels.	Per cent.	Barrels.	Per cent.
Standard Oil Co. (California)	14,365,188	15.64	12,360,208	13.80	13,550,809	13.08
Associated-Southern Pacific interests	19,801,566	21.57	18,665,997	20.84	17,319,452	16.71
Union Oil Co. of California	6,668,192	7.26	5,301,120	5.92	6,329,978	6.11
Shell Co. of California	4,751,629	5.18	3,104,044	3.47	4,322,833	[1] 4.17
Doheny companies	3,671,925	4.00	4,301,112	4.80	4,980,659	4.81
Santa Fe Railway	2,775,271	3.02	2,932,574	3.27	3,170,517	3.06
General Petroleum Corporation	[2] 1,573,146	1.71	.....	.....	.....	.....
Total	53,606,917	58.38	46,665,055	52.10	49,674,248	47.94
Other companies reporting to Commission	12,989,527	14.15	12,566,071	14.03	16,208,127	15.64
Production of companies not reporting to Commission	25,225,918	27.47	30,335,653	33.87	37,741,320	36.42
Total production of California	91,822,362	100.00	89,566,779	100.00	103,623,695	100.00

[1] Production of Shell Co. interests taken over by the Shell Co. of California in 1915.
[2] Covers production of the last 6 months of 1916.

TABLE 12.—*Stocks of crude petroleum, in barrels of 42 gallons, in California, 1914–1920.*

Date.	Standard Oil Co.	Independent Producers' Agency.	Date.	Standard Oil Co.	Independent Producers' Agency.
1914.	*Barrels.*	*Barrels.*	1915—Continued.	*Barrels.*	*Barrels.*
January	49,308,560	50,620,831	July	60,409,979	59,650,219
February	49,797,205	51,141,899	August	60,162,277	59,252,680
March	49,847,756	51,206,411	September	59,624,905	58,803,911
April	49,625,570	51,198,315	October	58,673,592	57,879,376
May	50,318,025	51,891,488	November	57,789,959	56,825,045
June	52,145,007	52,240,276	December	57,147,051	55,977,180
July	52,937,438	52,940,306			
August	53,188,857	54,018,481	1916.		
September	55,027,328	55,267,469	January	57,035,887	55,950,804
October	56,024,899	55,777,899	February	56,021,093	55,279,853
November	57,071,088	56,739,336	March	54,975,705	54,436,065
December	58,526,274	58,259,119	April	53,569,504	53,022,830
			May	52,672,741	51,917,764
1915.			June	51,199,918	51,048,239
January	59,276,301	58,800,937	July	51,133,849	50,780,447
February	60,527,306	59,589,371	August	49,718,180	49,311,395
March	60,777,316	59,628,933	September	48,469,257	47,886,462
April	60,656,177	59,770,789	October	47,318,150	46,956,705
May	60,820,315	59,696,714	November	45,914,181	45,369,971
June	60,616,286	59,554,625	December	44,036,190	43,640,294

TABLE 12.—*Stocks of crude petroleum, in barrels of 42 gallons, in California, 1914–1920*—Continued.

Date.	Standard Oil Co.	Independent Producers' Agency.	Date.	Standard Oil Co.	Independent Producers' Agency.
1917.	*Barrels.*	*Barrels.*	1919.	*Barrels.*	*Barrels.*
January	43,060,154	42,234,502	January	32,299,589	28,737,582
February	42,028,194	40,867,931	February	32,671,059	28,814,643
March	41,173,861	39,655,875	March	32,485,823	28,692,216
April	39,976,386	38,825,430	April	32,543,145	28,613,429
May	38,621,068	37,842,544	May	33,109,617	29,423,157
June	37,020,263	36,510,748	June	33,496,897	30,195,854
July	35,781,323	36,135,864	July	33,850,819	30,553,698
August	35,217,483	35,367,742	August	33,705,383	30,855,945
September	34,656,007	34,156,007	September	32,899,638	30,128,982
October	33,795,115	33,762,500	October	32,017,037	29,190,052
November	32,603,625	32,812,763	November	31,159,030	28,291,907
December	32,450,465	32,646,662	December	30,480,323	27,804,391
1918.			1920.		
January	31,772,465	31,913,095	January	29,611,625	26,893,730
February	31,360,378	31,341,254	February	28,738,921	25,969,174
March	30,831,316	31,052,769	March	27,578,364	24,866,470
April	28,839,748	30,288,960	April	27,111,984	24,432,175
May	29,265,488	30,698,718	May	26,591,897	23,914,537
June	30,042,232	30,207,175	June	25,370,903	22,748,592
July	30,523,910	29,984,123	July	24,406,753	21,826,343
August	30,703,666	29,185,891	August	23,434,464	20,863,817
September	30,898,465	28,829,063	September	23,158,657	20,589,217
October	31,822,923	29,028,486	October	22,545,026	19,985,849
November	32,265,746	29,208,479	November	22,582,304	19,951,838
December	32,042,923	29,145,368	December	22,240,271	19,618,846

TABLE 13.—*Balance sheets, Standard Oil Co. (California), as shown by company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916
ASSETS.			
Fixed assets:			
Plant account, etc	$74,777,632.98	$78,565,460.79	$88,400,040.33
Less depreciation	10,184,074.01	14,382,414.92	19,628,204.47
Net fixed assets	64,593,558.97	64,183,045.87	68,771,835.86
Current assets:			
Cash	1,173,377.36	1,986,662.72	2,646,755.47
Accounts receivable	4,774,145.32	5,201,323.90	7,985,275.77
Notes receivable	156,038.71	91,831.27	46,432.67
Inventory, oil	22,700,541.79	22,262,385.83	21,643,053.22
Inventory, material, etc	2,850,376.52	2,754,760.92	4,523,218.65
Total current assets	31,654,479.70	32,296,964.64	36,844,735.78
Deferred charges	148,465.37	312,716.16	445,508.58
Investments	80,000.00	99,369.36	99,369.36
Total	96,476,504.04	96,892,096.03	106,161,449.58
LIABILITIES.			
Capital stock	49,686,655.35	49,686,655.35	74,529,983.09
Current liabilities:			
Accounts payable	5,070,645.03	3,754,413.77	3,837,951.98
Notes payable	2,000,000.00		
Stock premium	250,000.00	250,000.00	250,000.00
Surplus	39,469,203.66	43,201,026.91	27,543,514.51
Total	96,476,504.04	96,892,096.03	106,161,449.58

TABLE 13.—*Balance sheets, Standard Oil Co. (California), as shown by company's records, 1914–June 30, 1919*—Continued.

Item.	1917	1918	1919 [1]
ASSETS.			
Fixed assets:			
Plant account, etc	$141,496,316.30	$152,332,996.12	$159,867,902.52
Less depreciation	28,308,636.05	40,806,042.05	47,310,993.63
Net fixed assets	113,187,680.25	111,526,954.07	112,556,908.89
Current assets:			
Cash	5,356,758.67	6,789,437.09	5,114,704.27
Accounts receivable	10,278,619.99	12,141,449.67	12,089,755.47
Notes receivable	93,273.84	100,717.47	123,763.75
Inventory, oil	18,759,720.40	18,145,608.34	21,640,025.65
Inventory, material, etc	8,039,843.64	11,453,374.65	11,108,261.46
Liberty loan accounts	1,007,892.77	2,695,060.50	1,463,263.70
Total current assets	43,536,109.31	51,325,647.72	51,539,774.30
Deferred charges	730,510.99	882,681.29	1,293,918.75
Investments	126,610 63	157,960.63	162,830.63
Investments, Government	1.550,000.00	10,102,269.04	7,777,319.04
Total	159,130,911.18	173,995,512.75	173,330,751.61
LIABILITIES.			
Capital stock	99,373,310.83	99,373,310.83	99,373,310.83
Current liabilities:			
Accounts payable	4,515,266.63	4,542,325.57	3,158,674.29
Notes payable	[2] 884,687.78	[2] 1,110,761.43	[2] 443,672.90
Income tax	5,830,116.50	19,405,462.10	5,000,000.00
Liberty loan accounts	797,400.00	2,249,300.00	3,843,190.00
Adjustment	1,363.89	.....	[3] 951.547.00
Suspended earnings	.....	489,537.87	651,167.99
Stock premium	250,000.00	250,000.00	250,000.00
Surplus	47,478,765.55	46,574,814.95	59,659,188.60
Total	159,130,911.18	173,995,512.75	173,330,751.61

[1] June 30.
[2] Merchandise due on contract.
[3] Compensation.

TABLE 14.—*Fixed investment, by departments, Standard Oil Co. (California), 1904 and 1914–June 30, 1919.*

Year.	Refining.	Marketing.	Producing.	Pipe lines.
1904	$2,119,548.81	.....	$271,213.88	$6,212,695.99
1914	16,961,518.99	$6,799,494.15	28,791,968.00	16,579,336.46
1915	19,518,663.82	7,487,119.76	30,856,267.38	14,686,306.04
1916	21,613,971.87	9,017,846.70	35,623,611.29	14,904,409.64
1917	24,580,082.92	10,616,305.59	81,655,413.52	15,614,077.37
1918	27,926,918.12	12,146,001.15	88,152,195.36	15,425,673.96
1919 [1]	29,441,626.52	13,248,298.93	93,047,391.02	15,708,740.23

Year.	Marine.	Other.	Total.
1904	$435,072.65	$6,925.55	$9,045,456.88
1914	4,516,375.72	1,168,939.66	74,777,632.98
1915	4,828,731.08	1,188,372.71	78,565,460.79
1916	5,867,587.92	1,372,612.91	83,400,040.33
1917	7,641,730.98	1,388,705.92	141,496,316.30
1918	7,281,093.83	1,401,113.70	152,332,996.12
1919 [1]	7,010,843.14	1,411,002.68	159,867,902.52

[1] June 30.

TABLE 15.—*Income account, Standard Oil Co. (California), as shown by company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916
Gross sales of oil	$38,663,469.87	$37,835,404.95	$55,434,659.24
Used, burned, etc.	1,027,829.11	2,007,332.14	2,295,133.61
Total	39,691,298.98	39,842,737.09	57,729,792.85
Less packages	1,048,950.69	1,196,738.01	1,935,142.62
Transportation	4,336,303.21	6,424,781.03	7,391,984.74
Trade discount	104,436.47	106,897.63	351,198.75
Marketing expense	4,114,535.69	4,571,660.78	6,150,958.48
Total	9,604,226.06	12,300,077.45	15,829,284.59
Net sales at refinery	30,087,072.92	27,542,659.64	41,900,508.26
Cost of sales:			
Cost of crude and equivalent	22,625,286.88	17,519,730.64	32,428,586.00
Refinery operating	5,734,513.93	5,646,756.04	6,300,413.15
Transportation	420,685.00	455,831.06	928,077.85
Purchased products	581,556.30	677,651.17	1,035,201.10
Inventory (increase or decrease)	−843,050.70	560,663.82	−368,748.24
Total	28,518,991.41	24,860,632.73	40,323,529.86
Net profit on oil sold	1,568,081.51	2,682,026.91	1,576,978.40
Other income:			
Oil-producing property	3,709,944.24	1,784,422.10	3,883,139.09
Pipe lines	2,921,749.50	2,059,922.35	8,500,312.30
Marine	383,737.80	1,174,734.46	688,900.88
Lamps, stoves, etc.	4,530.75	214,792.81	165,099.84
Rent	3,327.60	1,989.63	4,426.50
Interest and exchange	−1,821.54	−22,404.12	63,404.48
Miscellaneous	1,476,171.21	1,466,428.92	1,722,890.14
Total income	10,065,721.07	9,361,913.06	16,005,151.63
Deductions:			
Donations	14,048.50	3,832.63	7,249.37
Worthless accounts	139,388.56	169,175.80	157,182.82
General taxes	337,098.40	302,521.96	232,653.24
Sundries	39,667.39	185,893.86	190,335.73
Total	530,202.85	661,424.25	587,421.16
Net income	9,535,518.22	8,700,488.81	16,017,730.47

Item.	1917	1918	1919 [1]
Gross sales of oil	$78,983,365.21	$101,992,572.24	$51,095,082.75
Used, burned, etc.	2,893,478.66	4,628,114.45	2,070,130.65
Total	81,876,843.87	106,620,686.69	53,165,213.40
Less packages	3,120,333.00	5,225,692.98	2,506,632.12
Transportation	8,352,519.47	10,810,342.95	4,850,856.47
Trade discount	514,569.11	918,558.23	286,066.96
Marketing expense	8,786,564.12	11,596,688.30	7,248,541.85
Total	20,773,985.70	28,551,282.46	14,892,097.40
Net sales at refinery	61,102,858.17	78,069,404.23	38,273,116.00
Cost of sales:			
Cost of crude and equivalent	46,668,788.92	49,933,497.30	24,158,070.92
Refinery operating	9,420,843.24	11,884,321.40	7,759,816.34
Transportation	909,952.40	977,195.71	254,259.74
Purchased products	1,095,686.53	1,474,066.63	1,146,129.08
Inventory (increase or decrease)	215,943.50	−98,387.49	−365,423.00
Total	58,311,214.59	64,170,693.55	32,952,853.08
Net profit on oil sold	2,791,643.58	13,898,710.68	5,320,262.92
Other income:			
Oil-producing property	8,641,358.23	14,626,236.91	9,137,092.29
Pipe lines	10,440,196.69	3,945,173.97	1,258,331.52
Marine	484,677.50	1,865,319.40	880,793.23
Lamps, stoves, etc.	428,473.65	260,449.34	77,512.83

[1] First 6 months.

TABLE 15.—*Income account, Standard Oil Co. (California), as shown by company's records, 1914–June 30, 1919*—Continued.

Item.	1917	1918	1919
Other income—Continued.			
Rent	$28.425.94	$36,578.53	$22,725.36
Interest and exchange	102,453.05	426,600.83	186,165.26
Miscellaneous	2,049,775.16	1,996,298.09	1,307,559.94
Total income	24,967,003.80	37,055,367.75	18,190,443.35
Deductions:			
Donations	145,342.75	272,761.80	79,351.88
Worthless accounts	114,586.69	81,652.92	54,588.65
General taxes	795,098.01		
Sundries	385,802.50	553,379.67	169,816.34
Total	1,440,829.95	907,794.39	303,756.87
Net income	23,526,173.85	36,147,573.36	17,886,686.48

TABLE 16.—*Company's net and Commission's revised investment in petroleum business, Standard Oil Co. (California), 1914–June 30, 1919.*

Item.	1914	1915	1916
Company's investment:			
Capital stock	$49,686,655.35	$49,686,655.35	$74,529,983.09
Notes	2,000,000.00		
Stock premium account	250,000.00	250,000.00	250,000.00
Reserve (income tax)			
Surplus	39,469,203.66	43,201,026.91	27,543,514.51
Total	91,405,859.01	93,137,682.26	102,323,497.60
Deduct:			
Liberty bond account			
Stocks and bonds	80,000.00	99,369.36	99,369.36
Government securities			
Total	80,000.00	99,369.36	99,369.36
Less Liberty loan credits			
Net deductions	80,000.00	99,369.36	99,369.36
Company's investment in oil business	91,325,859.01	93,038,312.90	102,224,128.24
Add:			
Adjustment to balance			
Geological expense	3,437.43	9,400.13	24,946.97
Depreciation and depletion adjustment	96,223.92	360,171.95	1,216,481.18
Total addition	99,661.35	369,572.08	1,241,428.15
Deduct:			
Deferred charges	148,465.37	312,716.16	445,508.58
Additional compensation			
Appreciation	8,474,659.33	8,474,659.33	8,474,659.33
Total deduction	8,623,124.70	8,787,375.49	8,920,167.91
Net deduction	8,523,463.35	8,417,803.41	7,678,739.76
Revised investment in oil business	82,802,395.66	84,620,509.49	94,545,388.48

Item.	1917	1918	1919 [1]
Company's investment:			
Capital stock	$99,373,310.83	$99,373,310.83	$99,373,310.83
Notes			
Stock premium account	250,000.00	250,000.00	250,000.00
Reserve (income tax)	5,830,116.50	19,405,462.10	5,000,000.00
Surplus	47,478,765.55	46,574,814.95	60,610,735.60
Total	152,932,192.88	165,603,587.88	165,234,046.43

[1] June 30.

TABLE 16.—*Company's net and Commission's revised investment in petroleum business, Standard Oil Co. (California), 1914–June 30, 1919*—Continued.

Item.	1917	1918	1919
Deduct:			
Liberty bond account	$1,007,892.77	$2,695,060.50	$1,463,263.70
Stocks and bonds	126,610.63	157,960.63	162,830.63
Government securities	1,550,000.00	10,102,269.04	7,777,319.04
Total	2,684,503.40	12,955,290.17	9,403,413.37
Less Liberty loan credits	797,400.00	2,249,300.00	3,843,190.00
Net deductions	1,887,103.40	10,705,990.17	5,560,223.37
Company's investment in oil business	151,045,089.48	154,897,597.71	159,673,823.06
Add:			
Adjustment to balance	1,363.89		
Geological expense	45,633.53	68,678.57	96,707.34
Depreciation and depletion adjustment	4,810,300.01	12,004,191.91	15,679,548.19
Total addition	4,857,297.43	12,072,870.48	15,776,255.53
Deduct:			
Deferred charges	730,510.99	882,681.29	1,293,918.75
Additional compensation			951,547.00
Appreciation	47,087,425.80	46,748,439.43	46,578,946.27
Total deduction	47,817,936.79	47,631,120.72	48,824,412.02
Net deduction	42,960,639.36	35,558,250.24	33,048,156.49
Revised investment in oil business	108,084,450.12	119,339,347.47	126,625,666.57

TABLE 17.—*Company's income and Commission's revised income from petroleum business, Standard Oil Co. (California), 1914–June 30, 1919.*

Item.	1914	1915	1916
Company's income from entire business	$9,535,518.22	$8,700,488.81	$16,017,730.47
Deduct interest and exchange			
Company's net income from oil business	9,535,518.22	8,700,488.81	16,017,730.47
Add:			
Geological expense	3,437.43	5,962.70	15,546.84
Depreciation adjustment	96,223.92	263,948.03	856,309.23
Abandoned property	453,771.47.		541,683.49
Adjustment of appreciation			
Suspended earnings			
Total	553,432.82	269,910.73	1,413,539.56
Revised income from oil business	10,088,951.04	8,970,399.54	17,431,270.03

Item.	1917	1918	1919 [1]
Company's income from entire business	$23,526,173.85	$36,147,573.36	$17,886,686.48
Deduct interest and exchange	102,453.05	426,600.83	186,165.26
Company's net income from oil business	23,423,720.80	35,720,972.53	17,700,521.22
Add:			
Geological expense	20,686.56	23,045.04	28,028.77
Depreciation adjustment	1,044,884.95	1,955,445.12	735,609.13
Abandoned property	319,813.42	232,676.60	139,774.12
Adjustment of appreciation	338,986.37	338,986.37	169,493.16
Suspended earnings		489,537.87	161,630.12
Total	1,724,371.30	3,039,691.00	1,234,535.30
Revised income from oil business	25,148,092.10	38,760,663.53	18,935,056.52

[1] First 6 months.

TABLE 18.—*Balance sheets, Union Oil Co. of California, as shown by company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916
ASSETS.			
Fixed assets:			
Plant account	$43,528,178.04	$44,512,331.98	$46,015,734.21
Less depreciation	6,597,384.46	8,363,071.20	9,609,168.12
Net fixed assets	36,930,793.58	36,149,260.78	36,406,566.09
Current assets:			
Cash	981,304.94	1,061,217.76	2,082,753.20
Accounts receivable / Notes receivable	3,215,328.65	3,460,520.56	4,770,369.00
Inventory, crude oil	4,368,215.23	4,295,159.99	5,663,296.04
Inventory, refined oil	1,070,288.01	1,330,410.18	1,631,015.04
Inventory, material and supplies	709,819.11	821,012.89	1,262,393.93
Deferred charges	203,392.23	275,853.07	288,505.74
Affiliated companies: Accounts receivable	1,186,926.86	1,168,633.14	890,947.71
Investments:			
Stock and bonds (other companies)	12,012,249.09	10,002,677.73	11,090,530.90
Other			
Total assets	60,678,317.70	58,564,746.10	64,026,377.65
LIABILITIES.			
Capital stock	33,745,900.00	34,092,200.00	34,092,200.00
Funded debt, bonds and mortgages	8,240,000.00	8,002,000.00	8,611,000.00
Invested notes	3,984,714.74	2,526,915.02	2,465,362.30
Purchase money obligations			
Current liabilities:			
Accounts payable	1,036,363.54	851,616.71	1,843,669.07
Notes payable	1,600,000.00	1,200,000.00	
Accrued liabilities	90,166.82	67,930.59	138,543.98
Reserves	192,500.00	206,732.58	314,010.47
Surplus	11,788,672.60	11,617,351.20	16,561,591.83
Total liabilities	60,678,317.70	58,564,746.10	64,026,377.65

Item.	1917	1918	1919[1]
ASSETS.			
Fixed assets:			
Plant account	$63,919,619.73	$70,513,510.83	$69,490,223.65
Less depreciation	14,863,669.01	19,076,435.54	17,770,748.08
Net fixed assets	49,055,950.72	51,437,075.29	51,719,475.57
Current assets:			
Cash	2,610,087.92	3,083,360.40	4,177,263.03
Accounts receivable / Notes receivable	6,134,910.82	7,117,978.56	5,988,903.71
Inventory, crude oil	7,095,712.19	7,197,682.94	6,581,579.67
Inventory, refined oil	2,911,788.94	2,781,131.88	2,394,952.45
Inventory, material and supplies	1,984,325.82	2,674,768.80	2,772,159.09
Deferred charges	380,293.10	435,193.51	461,932.14
Affiliated companies: Accounts receivable	1,177,839.43	874,170.42	890,843.88
Investments:			
Stocks and bonds (other companies)	5,286,948.06	3,118,727.12	3,478,399.64
Other	1,151,250.00	1,553,575.32	3,706,936.06
Total assets	77,789,107.00	80,273,664.24	82,162,445.24
LIABILITIES.			
Capital stock	39,510,100.00	43,567,500.00	43,571,500.00
Funded debt, bonds and mortgages	11,688,000.00	11,331,000.00	11,033,000.00
Invested notes	390,000.00		
Purchase money obligations	761,653.58	589,790.86	575,616.14
Current liabilities:			
Accounts payable	2,263,947.63	2,967,844.87	2,902,804.12
Notes payable			
Accrued liabilities	1,479,207.38	2,002,221.53	1,062,735.30
Reserves	458,312.20	488,590.58	511,016.89
Surplus	21,237,886.21	19,326,716.40	22,505,772.79
Total liabilities	77,789,107.00	80,273,664.24	82,162,445.24

[1] June 30.

TABLE 19.—*Fixed investment by departments, Union Oil Co. of California, 1914–June 30, 1919.*

Year.	Refining.	Marketing.	Producing.	Pipe lines.
1914	$2,453,763.72	$3,721,385.92	$30,295,467.95	$2,927,122.11
1915	2,526,229.09	4,051,013.01	30,328,179.98	2,541,253.51
1916	3,275,807.97	4,223,631.51	30,964,674.47	1,527,983.45
1917	3,937,585.65	5,010,900.46	38,582,015.23	10,311,679.90
1918	5,045,682.86	6,461,451.83	43,572,660.31	10,348,031.24
1919[1]	5,800,777.34	7,007,819.12	40,506,489.55	10,437,332.74

Year.	Marine.	Other.	Total.
1914	$3,613,301.13	$517,137.21	$43,528,178.04
1915	4,262,477.22	803,179.17	44,512,331.98
1916	5,205,875.94	817,760.87	46,015,734.21
1917	5,213,689.73	863,748.76	63,919,619.73
1918	5,085,684.59	.....	70,513,510.83
1919[1]	5,084,228.02	653,576.88	69,490,223.65

[1] June 30.

TABLE 20.—*Income account, Union Oil Co. of California, as shown by company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916
Gross sales	$10,036,621.68	$19,248,143.15	$27,757,395.97
Less packages	.....	219,637.61	285,930.41
Transportation	.....	4,970,225.14	6,576,316.84
Marketing expense	1,205,044.38	2,558,356.08	3,092,044.94
Total	1,205,044.38	7,748,218.83	9,954,292.19
Net sales at refinery	8,831,577.30	11,499,924.32	17,803,103.78
Cost of sales:			
Cost of crude and equivalent	6,035,342.43	10,095,344.41	14,716,685.92
Refinery operating	1,096,164.56	1,081,355.57	1,443,233.38
Purchased products	.....	29,123.35	68,582.73
Inventory (increase or decrease)	651,630.56	−311,147.25	−78,205.64
Total cost of sales	7,783,137.55	10,894,676.08	16,150,296.39
Net profit on oil sold	1,048,439.75	605,248.24	1,652,807.39
Other income.			
Oil-producing property	722,623.08	623,217.87	2,679,770.89
Pipe lines	274,942.98	202,199.24	272,681.08
Marine	932,903.98	1,195,855.42	1,493,205.85
Dividends received	1,082,290.56	692,547.42	1,655,650.42
Miscellaneous	9,413.32	20,424.17	9,210.25
Total income	4,070,613.67	3,339,492.36	7,763,325.88
Deductions:			
Interest	623,003.47	520,363.18	481,728.01
Taxes, income	.....	.....	57,034.19
Taxes, excess profits	.....	.....	.....
Other operations	712,085.77	.....	.....
Total	1,335,089.24	520,363.18	538,762.20
Net income	2,735,524.43	2,819,129.18	7,224,563.68

TABLE 20.—*Income account, Union Oil Co. of California, as shown by company's records, 1914–June 30, 1919*—Continued.

Item.	1917	1918	1919 [1]
Gross sales	$33,911,301.32	$43,952,542.53	$25,084,356.31
Less packages	256,499.77	384,319.71	
Transportation	6,564,364.16	4,568,193.44	3,406,505.11
Marketing expense	4,205,530.59	4,826,239.51	2,552,174.22
Total	11,026,394.52	9,778,752.66	5,958,679.33
Net sales at refinery	22,884,906.80	34,173,789.87	19,125,677.01
Cost of sales:			
Cost of crude and equivalent	19,580,784.17	30,114,186.03	15,015,745.80
Refinery operating	1,763,542.14	2,365,917.21	1,709,924.21
Purchased products	140,059.51	161,585.17	34,104.15
Inventory (increase or decrease)	−659,075.38	−8,381.47	163,094.28
Total cost of sales	20,825,310.44	32,633,306.94	16,922,868.44
Net profit on oil sold	2,059,596.36	1,540,482.93	2,202,808.57
Other income:			
Oil-producing property	4,287,244.17	4,771,532.95	3,053,519.84
Pipe lines	81,704.44	687,267.95	377,923.64
Marine	1,751,098.57	834,985.13	−177,654.48
Dividends received	1,360,209.27	272,372.14	300,199.07
Miscellaneous	16,854.17		
Total income	9,556,706.98	8,106,641.10	5,756,796.64
Deductions:			
Interest	576,472.11	533,501.85	186,084.25
Taxes, income	1,281,696.87	1,550,000.00	
Taxes, excess profits			
Other operations	56,253.87		
Total	1,914,422.85	2,083,501.85	186,084.25
Net income	7,642,284.13	6,023,139.25	5,570,712.39

[1] First 6 months.

TABLE 21.—*Company's net and Commission's revised investment in petroleum business, Union Oil Co. of California, 1914–June 30, 1919.*

Item.	1914	1915	1916
Company's investment:			
Capital stock	$33,745,900.00	$34,092,200.00	$34,092,200.00
Bonds	8,240,000.00	8,002,000.00	8,611,000.00
Collateral notes	2,999,000.00	2,000,000.00	1,319,000.00
Purchase money obligations	985,714.74	526,915.02	1,146,362.30
Surplus	11,788,672.60	11,617,351.20	16,561,591.83
Company's total investment	57,759,287.34	56,238,466.22	61,730,154.13
Deduct:			
Stocks and bonds in other companies	12,012,249.09	10,002,677.73	11,090,530.90
Affiliated companies—accounts receivable	1,186,926.86	1,168,633.14	830,947.71
Total deductions	13,199,175.95	11,171,310.87	11,921,478.61
Company's investment in oil business	44,560,111.39	45,067,155.35	49,808,675.52
Other deductions:			
Deferred charges	203,392.23	275,853.07	288,505.74
Depreciation and depletion adjustment	348,383.13	458,097.74	405,942.94
Appreciation	8,604,524.80	8,604,524.80	8,604,524.80
Total, other deductions	9,156,300.16	9,338,475.61	9,298,973.48
Commission's revised investment in oil business	35,403,811.23	35,728,679.74	40,509,702.04

TABLE 21.—*Company's net and Commission's revised investment in petroleum business, Union Oil Co. of California, 1914–June 30, 1919*—Continued.

Item.	1917	1918	1919 [1]
Company's investments:			
Capital stock	$39,510,100.00	$43,567,500.00	$43,571,300.00
Bonds	11,688,000.00	11,331,000 00	11,033,000.00
Collateral notes	390,000.00		
Purchase money obligations	761,653.58	589,790.86	575,616.14
Surplus	21,237,886.21	19,326,716.40	22,505,772.79
Company's total investment	73,587,639.79	74,815,007.26	77,685,888.93
Deduct:			
Stocks and bonds in other companies	5,286,948.06	3,118,727.12	3,478,399.64
Government securities	1,151,250.00	1,553,575.32	3,706,936.06
Affiliated companies—accounts receivable	1,177,839.43	874,170.42	880,843.88
Total deductions	7,616,037.49	5,546,472.86	8,066,179.58
Company's investment in oil business	65,971,602.30	69,268,534.40	69,619,709.35
Other deductions.			
Deferred charges	380,293.10	435,193.51	461,932.14
Depreciation and depletion adjustment	516,919.09	48,046.09	[2] 74,274.55
Appreciation	8,604,524.80	8,604,524.80	8,604,524.80
Incidental drilling			[2] 658,537.53
Total other deductions	9,501,736.99	9,087,764.40	8,333,644.86
Commission's revised investment in oil business	56,469,865.31	60,180,770.00	61,286,064.49

[1] June 30. [2] Addition.

TABLE 22.—*Company's income and Commission's revised income from petroleum business, Union Oil Co. of California, 1914–June 30, 1919.*

Item.	1914	1915	1916
Income as shown by company	$2,735,524.43	$2,819,129.18	$7,224,563.68
Add income tax			57,034.19
Company's total income	2,735,524.43	2,819,129.18	7,281,597.87
Add interest	505,355.77	483,292.63	494,979.97
Deduct dividends received	1,082,290.56	692,547.42	1,655,650.42
Net deductions	576,934.79	209,254.79	1,160,670.45
Company's net income from oil business	2,158,589.64	2,609,874.39	6,120,927.42
Deduct:			
Depreciation and depletion adjustment	348,383.13	109,714.61	[1] 52,154.80
Abandoned property			
Incidental drilling			
Total deductions	348,383.13	109,714.61	[1] 52,154.80
Net revised income	1,810,206.51	2,500,159.78	6,173,082.22

Item.	1917	1918	1919 [2]
Income as shown by company	$7,642,284.13	$6,023,139.25	$5,570,712.39
Add income tax	1,281,696.87	1,550,000.00	
Company's total income	8,923,981.00	7,573,139.25	5,570,712.39
Add interest	546,987.92	577,802.82	280,165.39
Deduct dividends received	1,360,209.27	272,372.14	300,199.07
Net deductions	813,221.35	[1] 305,430.68	20,033.68
Company's net income from oil business	8,110,759.65	7,878,569.93	5,550,678.71
Deduct:			
Depreciation and depletion adjustment	110,976.15	[1] 468,873.00	[1] 122,320.64
Abandoned property			[1] 37,141.94
Incidental drilling			[1] 658,537.53
Total deductions	110,976.15	[1] 468,873.00	[1] 818,000.11
Net revised income	7,999,783.50	8,347,442.93	6,368,678.82

[1] Addition. [2] First 6 months.

TABLE 23.—*Balance sheets, Associated Oil Co., as shown by company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916
ASSETS.			
Plant account	$55,999,642.95	$56,935,354.77	$60,074,716.57
Less depreciation	9,310,231.27	11,406,992.76	13,896,164.89
Net fixed assets	46,689,411.68	45,528,362.01	46,178,551.68
Current assets:			
Cash	1,950,278.80	2,406,234.44	1,480,806.62
Accounts receivable	1,229,725.99	1,405,248.83	2,052,648.67
Notes receivable	23,145.58	7,281.71	21,330.37
Inventory, oil	3,252,845.40	2,041,153.89	1,938,804.22
Inventory, material and supplies	138,771.67	143,299.03	423,927.78
Inventory, other	225,877.22	135,182.01	125,708.25
Total	6,820,644.66	6,138,399.91	6,043,225.91
Deferred charges	1,860,443.19	1,571,206.77	1,255,461.28
Affiliated companies:			
Accounts and notes receivable	1,758,477.22	1,527,540.82	1,679,241.32
Stocks and bonds	5,192,347.09	5,141,007.09	5,002,270.14
Investments:			
Other stocks and bonds	163,988.00	161,613.00	161,613.00
Other			
Other assets (sinking fund)	890,378.69	972,516.19	1,042,247.29
Total assets	63,375,690.53	61,040,645.79	61,362,610.62
LIABILITIES.			
Capital stock	39,758,462.00	39,757,404.00	39,756,792.00
Funded debt	15,212,000.00	13,331,000.00	12,299,000.00
Current liabilities:			
Accounts payable	593,547.53	607,343.55	1,517,851.11
Notes payable			312,500.00
Accrued liabilities	1,497,416.59	1,331,391.71	576,803.29
Total	2,090,964.12	1,938,735.26	2,407,154.40
Affiliated companies:			
Accounts payable	40,919.71	51,586.36	272,606.34
Reserves			
Surplus	6,273,344.70	5,961,920.17	6,627,057.88
Total	63,375,690.53	61,040,645.79	61,362,610.62

Item.	1917	1918	1919[1]
ASSETS.			
Plant account	$62,509,123.90	$63,437,580.78	$64,912,407.81
Less depreciation	16,559,458.13	19,056,499.57	20,297,852.51
Net fixed assets	45,949,665.77	44,381,081.21	44,614,555.30
Current assets:			
Cash	1,648,927.03	1,225,414.04	428,926.91
Accounts receivable	2,902,789.68	2,593,809,86	2,525,800.37
Notes receivable	30,881.45	99,136.80	35,513.29
Inventory, oil	2,794,080.41	2,843,686.16	4,447,242.25
Inventory, material and supplies	931,826.74	1,413,706.97	1,359,948.35
Inventory, other	131,663.40	357,680.55	458,557.41
Total	8,440,168.71	8,538,434.38	9,255,988.58
Deferred charges	1,221,158.45	1,061,076.32	1,151,285.65
Affiliated companies:			
Accounts and notes receivable	1,247,290.19	1,958,978.92	2,176,462.05
Stocks and bonds	6,416,594.23	6,277,715.77	7,127,790.77
Investments:			
Other stocks and bonds	161,613.00	161,613.00	163,506.00
Other	438,495.91	2,039,882.67	2,409,578.51
Other assets (sinking fund)	895,567.55	902,831.62	402.87
Total assets	64,770,553.81	65,321,613.89	66,959,569.73

[1] June 30.

TABLE 23.—*Balance sheets, Associated Oil Co., as shown by company's records, 1914–June 30, 1919*—Continued.

Item.	1917	1918	1919
LIABILITIES.			
Capital stock	$39,756,641.00	$39,756,314.00	$39,756,148.00
Funded debt	12,517,787.50	10,880,000.00	10,731,000.00
Current liabilities:			
Accounts payable	4,306,622.71	2,061,583.33	2,013,344.84
Notes payable	112,500.00		
Accrued liabilities	569,621.32	3,111,452.63	2,473,315.21
Total	4,988,744.03	5,173,035.96	4,486,660.05
Affiliated companies:			
Accounts payable	165,805.48	189,145.36	508,842.37
Reserves			275,500.00
Surplus	7,341,575.80	9,323,118.57	11,201,419.31
Total	64,770,553.81	65,321,613.89	66,959,569.73

TABLE 24.—*Fixed investment*[1] *by departments, Associated Oil Co., 1914–June 30, 1919.*

Year.	Refining.	Marketing.	Producing.	Pipe lines.
1914	$1,392,795.12	$829,676.27	$34,609,592.44	$6,644,159.70
1915	1,527,638.65	919,589.88	33,745,494.61	6,359,346.74
1916	1,899,476.59	1,224,558.75	33,677,358.58	6,667,524.76
1917	1,990,687.76	1,243,972.61	33,343,723.47	6,903,736.52
1918	2,000,797.27	1,266,604.14	32,120,001.07	6,766,968.63
1919[2]	2,212,971.50	1,440,899.76	32,263,031.31	6,542,705.12

Year.	Marine.	Other.	Total.
1914	$2,833,875.10	$379,313.05	$46,689,411.68
1915	2,656,018.35	320,273.78	45,528,362.01
1916	2,523,968.71	185,664.29	46,178,551.68
1917	2,345,154.90	122,390.51	45,949,665.77
1918	2,166,810.20	59,899.90	44,381,081.21
1919[2]	2,092,791.73	62,155.88	44,614,555.30

[1] Net investment. [2] June 30.

TABLE 25.—*Income account, Associated Oil Co., as shown by company's records, 1914–June 30, 1919.*

Item.	1914	1915	1916
Gross sales	$12,372,209.71	$12,535,424.27	$17,722,466.80
Less transportation	1,860,940.65	1,910,553.88	2,593,358.61
Less marketing expense	572,823.62	665,508.53	952,346.49
Total	2,433,764.27	2,576,062.41	3,545,705.10
Net sales	9,938,445.44	9,959,361.86	14,176,761.70
Cost of sales:			
Crude oil etc., to refineries	3,715,597.37	4,005,660.06	8,745,155.46
Crude inventory (increase or decrease)	179,219.55	35,993.07	[1] 223,701.09
Refinery operating	345,163.81	352,906.32	504,463.17
Purchased products	1,142.16	22,427.45	85,088.82
Crude fuel oil	6,106,793.87	5,279,656.70	6,449,072.38
Inventory fluctuations refined etc	369,134.05	1,175,698.44	326,050.76
Total	10,717,050.81	10,872,342.04	15,886,129.50
Net profit on oil sold	[1] 778,605.37	[1] 912,980.18	[1] 1,709,367.80

[1] Loss.

TABLE 25.—*Income account, Associated Oil Co., as shown by company's records, 1914–June 30, 1919*—Continued.

Item.	1914	1915	1916
Income, other operations, etc.:			
Production	[1] $472,819.04	[1] $368,227.61	$1,204,700.41
Pipe lines	2,073,758.85	2,723,902.47	2,532,524.92
Marine	212,302.32	371,966.94	603,229.00
Tank cars	[1] 41,309.82	[1] 26,456.10	[1] 31,779.62
Dividends	598,401.25	480,818.15	406,679.35
Interest	18,945.77	120,732.00	105,365.30
Miscellaneous earnings	512,307.17	491,650.52	513,329.46
Gross income	2,122,261.13	2,879,429.18	3,913,770.92
Deductions:			
Interest funded debt	764,402.12	748,407.46	620,790.13
Interest, other	1,771.33	60,438.13	57,928.06
Income tax	11,072.74	16,023.13	80,271.94
Bond discount	90,518.28	89,344.81	77,720.64
Miscellaneous		41,758.75	44,441.27
Total deductions	867,764.47	955,972.28	881,152.04
Net income	1,254,516.66	1,923,456.90	3,032,618.88

Item.	1917	1918	1919[2]
Gross sales	$24,591,673.28	$27,247,119.72	$14,205,127.90
Less transportation	1,884,371.98	2,575,964.85	1,204,982.75
Less marketing expense	1,301,998.93	1,685,770.74	937,970.74
Total	3,186,370.91	4,261,735.59	2,142,953.49
Net sales	21,405,302.37	22,985,384.13	12,062,174.41
Cost of sales:			
Crude oil etc., to refineries	11,492,541.55	11,712,299.48	6,260,289.53
Crude inventory (increase or decrease)	263,608.92	[1] 170,826.86	[1] 269,728.00
Refinery operating	792,292.94	979,699.47	503,296.55
Purchased products	105,061.49	270,525.25	262,097.95
Crude fuel oil	11,181,548.23	8,284,239.98	5,599,111.01
Inventory fluctuations refined etc	[1] 1,118,885.11	121,221.11	[1] 1,333,828.09
Total	22,716,168.02	21,197,158.43	11,021,238.95
Net profit on oil sold	[1] 1,310,865.65	1,788,225.70	1,040,935.46
Income, other operations, etc.:			
Production	2,607,872.57	3,101,889.63	1,480,735.76
Pipe lines	1,915,271.24	1,059,685.56	404,645.40
Marine	857,712.76	1,392,827.18	463,018.70
Tank cars	[1] 53,490.56	[1] 36,853.91	[1] 8,018.96
Dividends	156,103.35	50,177.90	17,516.95
Interest	94,166.71	140,584.07	79,124.40
Miscellaneous earnings	617,376.08	637,381.03	352,957.03
Gross income	4,884,146.50	8,133,917.16	3,830,914.74
Deductions:			
Interest funded debt	586,406.25	537,514.56	269,142.62
Interest, other	152,749.30	140,100.01	13,815.99
Income tax	172,117.80	2,803,942.07	767,719.38
Bond discount	74,041.72	66,971.06	29,825.78
Miscellaneous	49,797.24	[1] 20,295.63	[1] 37,592.52
Total deductions	1,035,112.31	3,528,232.07	1,032,911.25
Net income	3,849,034.19	4,605,685.09	2,798,003.49

[1] Loss.

[2] First 6 months.

TABLE 26.—*Company's net and Commission's revised investment in petroleum business, Associated Oil Co., 1914–June 30, 1919.*

Item.	1914	1915	1916
Company's investment:			
Capital stock	$39,758,462.00	$39,757,404.00	$39,756,792.00
Bonds	15,212,000.00	13,331,000.00	12,209,000.00
Surplus	6,273,344.70	5,961,920.17	6,627,057.88
Total	61,243,806.70	59,050,324.17	58,682,849.88
Deductions:			
Investments in controlled companies—net	6,909,904.61	6,616,961.55	6,408,905.12
Other stocks and bonds	163,988.00	161,613.00	161,613.00
Trustees' sinking fund	890,378.69	972,516.19	1,042,247.29
Total	7,964,271.30	7,751,090.74	7,612,765.41
Company's investment in oil business	53,279,535.40	51,299,233.43	51,070,084.47
Additions:			
Income tax			[1] 32,918.69
Depreciation and depletion adjustment	53,635.23	[1] 41,044.56	92,469.33
Total	53,635.23	[1] 41,044.56	125,388.02
Deductions:			
Appreciation	7,502,198.79	7,502,198.79	7,502,198.79
Deferred charges	1,860,443.19	1,571,206.77	1,255,461.28
Total	9,362,641.98	9,073,405.56	8,757,660.07
Net deductions	9,309,006.75	9,114,450.12	8,632,272.05
Commission's revised investment in oil business	43,970,528.65	42,184,783.31	42,437,812.42

Item.	1917	1918	1919 [2]
Company's investment:			
Capital stock	$39,756,641.00	$39,756,314.00	$39,756,148.00
Bonds	12,517,787.50	10,880,000.00	10,731,000.00
Surplus	7,341,575.80	9,323,118.57	11,201,419.31
Total	59,616,004.30	59,959,432.57	61,688,567.31
Deductions:			
Investments in controlled companies—net	7,498,078.94	8,047,549.33	8,795,410.45
Other stocks and bonds	600,108.91	2,201,495.67	2,633,084.51
Trustees' sinking fund	895,567.55	902,831.62	402.87
Total	8,993,755.40	11,151,876.62	[1] 1,428,897.83
Company's investment in oil business	50,622,248.90	48,807,555.95	50,259,669.48
Additions:			
Income tax	128,306.10	2,741,976.52	2,087,634.52
Depreciation and depletion adjustment	297,750.45	427,650.58	630,029.37
Incidental drilling		295,978.15	421,919.50
Total	426,056.55	3,468,605.25	3,139,583.39
Deductions:			
Marine equipment, depreciation, etc			275,500.00
Appreciation	7,502,198.79	7,502,198.79	7,502,198.79
Deferred charges	1,221,158.45	1,061,076.32	1,151,285.65
Total	8,723,357.24	8,563,275.11	8,928,984.44
Net deductions	8,297,300.69	5,094,669.86	5,789,401.05
Commission's revised investment in oil business	42,324,948.21	43,712,886.09	44,470,268.43

[1] Deduction.

[2] June 3.

TABLE 27.—*Company's income and Commission's revised income from petroleum business, Associated Oil Co., 1914–June 30, 1919.*

Item.	1914	1915	1916
Company's income	$1,254,516.66	$1,923,456.90	$3,032,618.88
Add back excess profits tax—deducted	11,072.74	16,462.38	80,271.94
Company's income from entire business	1,265,589.40	1,939,919.28	3,112,890.82
Add:			
Interest on bonds	764,402.12	748,407.46	620,790.13
Discount on bonds	90,518.28	89,344.81	77,720.64
Total	854,920.40	837,752.27	698,510.77
Deduct.			
Dividends received	598,401.25	480,818.15	408,679.35
Interest from affiliated companies	18,245.77	22,638.31	33,163.20
Interest from sinking fund			7,251.58
Total	616,647.02	503,456.46	447,094.13
Net additions	238,273.38	334,295.81	251,416.64
Company's income from oil business	1,503,862.78	2,274,215.09	3,364,307.46
Additions—depreciation and depletion	53,635.22	[1] 94,679.78	133,513.89
Commission's revised income from oil business	1,557,498.00	2,179,535.31	3,497,821.35

Item.	1917	1918	1919[2]
Company's income	$3,849,034.19	$4,605,685.09	$2,798,003.49
Add back excess profits tax—deducted	172,449.05	2,804,538.57	767,719.38
Company's income from entire business	4,021,483.24	7,410,223.66	3,565,722.87
Add:			
Interest on bonds	586,406.25	537,514.56	259,142.62
Discount on bonds	74,041.72	66,971.06	29,825.78
Total	660,447.97	604,485.62	288,968.40
Deduct:			
Dividends received	156,103.35	50,177.90	17,516.95
Interest from affiliated companies	20,237.27	32,510.94	2,749.76
Interest from sinking fund	10,195.51	7,966.84	738.69
Total	186,636.13	90,655.68	21,005.40
Net additions	473,811.84	513,829.94	267,963.00
Company's income from oil business	4,495,295.08	7,924,053.60	3,833,685.87
Additions:			
Depreciation and depletion	205,281.12	129,900.13	[1] 73,121.21
Incidental drilling		295,978.15	125,941.35
Total	205,281.12	425,878.28	52,820.14
Commission's revised income from oil business	4,700,576.20	8,349,931.88	3,886,506.01

[1] Deduction.

[2] First 6 months.

TABLE 28.—*Balance sheets, General Petroleum Corporation, as shown by company's records, 1916–June 30, 1919.*

Item.	1916	1917	1918	1919[1]
ASSETS.				
Fixed assets:				
Plant and properties	$16,830,109.38	$20,783,111.05	$22,286,232.20	$24,161,811.13
Less depreciation etc	410,722.39	1,515,849.69	2,752,599.50	4,361,533.40
Net property	16,419,386.99	19,267,261.36	19,533,632.70	19,800,277.73
Current assets:				
Cash	134,452.92	400,715.71	306,640.70	642,967.88
Accounts receivable	1,020,440.33	1,478,204.72	2,318,335.92	3,125,260.54
Notes receivable	21,189.26	715.71	638,715.71	903,000.00
Inventory, oil	918,401.45	1,355,852.65	1,611,068.44	1,637,675.98
Inventory, other	351,826.95	1,374,175.11	949,447.27	1,476,617.31
Total current assets	2,446,310.91	4,609,663.90	5,824,208.04	7,785,521.71
Deferred charges	92,107.00	82,546.37	66,202.02	60,615.65
Other stocks and bonds	4,176,499.97	5,301,014.39	5,748,859.58	5,531,949.01
Total assets	23,134,304.87	29,260,486.02	31,172,902.34	33,178,364.10
LIABILITIES.				
Capital stock	16,702,400.00	16,702,400.00	16,702,400.00	20,429,800.00
Notes and bonds	903,000.00	2,550,000.00	1,850,000.00	1,762,634.04
Current liabilities:				
Accounts payable	524,344.46	900,013.00	1,204,726.75	1,143,349.79
Notes payable	325,577.50	716,490.00	248,312.50	45,000.00
Total	849,921.96	1,616,503.00	1,453,039.25	1,188,349.79
Accrued liabilities	296,523.23	1,019,897.47	593,624.99	839,262.41
Affiliated companies:				
Accounts and notes payable	626,348.62	1,012,708.50	280,889.41	
Surplus	290,840.20	2,395,789.82	4,372,744.74	3,663,376.35
Reserves	3,465,270.86	3,963,187.23	5,920,203.95	5,294,941.51
Total liabilities	23,134,304.87	29,260,486.02	31,172,902.34	33,178,364.10

[1] June 30.

TABLE 29.—*Fixed investment by departments, General Petroleum Corporation, 1916–June 30, 1919.*

Year.	Producing.	Refining.	Marketing.	Pipe lines.[1]
1916	$15,749,685.22	$458,845.16	$99,357.68	$6,430,494.99
1917	19,363,574.27	922,473.19	100,690.10	6,607,713.75
1918	17,529,966.50	1,271,298.18	787,536.47	7,045,190.49
1919[2]	20,231,110.67	1,225,079.11	578,605.29	7,102,541.38

Year.	Marine.	Other.	Total.
1916	$291,755.03	$230,466.29	$23,260,604.37
1917	333,848.95	62,524.54	27,390,824.80
1918	25,786.71	1,186,669.49	27,846,447.84
1919[2]	146,134.78	1,798,956.09	31,082,427.32

[1] Controlled by company. [2] June 30.

TABLE 30.—*Income account, General Petroleum Corporation, as shown by company's records, 1916–June 30, 1919.*

Item.	1916 [1]	1917	1918	1919 [2]
Gross sales	$3,607,747.09	$13,520,017.52	$23,274,170.45	$9,070,716.07
Less marketing expense	81,430.95	186,854.16	301,497.62	190,577.45
Net sales	3,526,316.14	13,333,163.36	22,972,672.83	8,880,138.62
Cost of sales:				
Cost of crude, etc	1,667,432.75	6,093,937.30	14,250,668.61	5,734,960.87
Refinery operating	} 1,172,770.93	2,795,899.98	1,900,912.82	738,159.26
Transportation				
Cost of sales	2,840,203.68	8,889,837.28	16,151,581.43	6,473,120.13
Net profit on sales	686,112.46	4,443,326.08	6,821,091.40	2,407,018.49
Other income:				
Marine profit	253,066.31	515,358.45	2,299,668.92	312,306.78
Other profit	54,064.53	158,339.00	231,648.38	118,058.60
Gross income	993,243.30	5,117,023.53	9,352,408.70	2,837,383.87
Deductions:				
Taxes regular	42,500.00	110,628.65	65,052.08	47,244.11
Depreciation	214,073.04	446,094.03	630,943.60	429,908.12
Depletion	197,576.88	679,238.30	782,890.36	1,015,875.68
General expense	91,168.36	311,254.45	603,622.99	326,823.17
Uncollectible accounts	22.54	90.06	7,704.12	1,431.73
Interest on bonds	39,439.16	111,340.83	91,639.89	19,249.34
Interest on floating debt	10,476.36	57,268.78	44,898.48	49,493.11
Inventory adjustment		6,060.23	56,555.38	14,831.73
Drilling labor and incidentals		355,856.68	332,284.20	677,262.55
Amortization bonds		54,340.00	[3] 4,015.00	[4] 96,443.49
Amortization leases			60,915.31	[3] 20,305.08
Amortization patents			2,662.65	1,775.10
Abandoned leases				136,223.60
Income tax			2,790,386.99	[3] 1,676,268.00
Miscellaneous		19,229.64	[3] 48,924.55	[5] 73,000.00
Total deductions	595,256.34	2,151,401.65	5,416,616.50	1,192,988.65
Net income	397,986.96	2,965,621.88	3,935,792.20	1,644,395.22

[1] Last 6 months.
[2] First 6 months.
[3] Addition.
[4] Moving tanks.
[5] Adjustment of wages.

TABLE 31.—*Company's net and Commission's revised investment in petroleum business, General Petroleum Corporation, 1916–June 30, 1919.*

Item.	1916	1917	1918	1919 [1]
Company's investment:				
Capital stock	$16,702,400.00	$16,702,400.00	$16,702,400.00	$20,429,800.00
Bonds and notes	903,000.00	2,550,000.00	947,000.00	610,000.00
Land-purchase obligations	117,000.00	500,000.00	530,000.00	772,634.04
Surplus	290,840.20	2,395,789.82	4,372,744.74	3,663,376.35
Reserves	3,000,000.00	3,000,000.00	3,000,000.00	3,000,000.00
Capital surplus	465,270.86	963,187.23	2,859,288.64	2,221,941.51
Total	21,478,511.06	26,111,377.05	28,411,433.38	30,697,751.90
Deductions:				
Investment in controlled companies (net)	3,505,394.74	3,899,330.89	3,557,291.34	3,785,381.19
Mortgage sinking fund (trustee)	5,000.00	212,425.00	230,215.52	66,119.76
Liberty bonds (net)		121,350.00	758,000.00	1,988,200.00
Total	3,508,394.74	4,233,105.89	4,545,506.86	5,839,700.95
Company's investment in oil business	17,970,116.32	21,878,271.16	23,865,926.52	24,858,050.95

[1] June 30.

TABLE 31.—*Company's net and Commission's revised investment in petroleum business, General Petroleum Corporation, 1916–June 30, 1919*—Continued.

Item.	1916	1917	1918	1919
Additions:				
Field research				$29,783.93
Scouting and leasing		$848.27	$1,395.68	4,155.68
Geological		394.86	4,550.88	4,550.88
Depreciation and depletion adjustment	$136,681.41	523,942.39	1,074,628.06	1,898,436.15
Incidental drilling		332,187.34	626,213.68	901,356.37
Depletion (surplus)				398,360.93
Total	136,681.41	857,372.86	1,706,788.30	3,236,643.94
Deductions:				
Appreciation	3,465,270.86	3,963,187.23	3,963,047.34	4,312,297.34
Deferred charges	92,107.00	82,546.37	66,202.02	60,615.65
Total	3,557,377.86	4,045,733.60	4,029,249.36	4,372,912.99
Net deductions	3,420,696.45	3,188,360.74	2,322,461.06	1,136,269.05
Revised investment in oil business	14,549,419.87	18,689,910.42	21,543,465.46	23,721,781.90

TABLE 32.—*Company's income and Commission's revised income from petroleum business, General Petroleum Corporation, 1916–June 30, 1919.*

Item.	1916 [1]	1917	1918	1919 [2]
Company's income	$397,986.96	$2,965,621.88	$3,935,792.20	$1,644,395.22
Add income tax (income)			2,790,386.99	[3] 1,676,268.00
Company's total income	397,986.96	2,965,621.88	6,726,179.19	[4] 31,872.78
Add:				
Interest paid on bonds	39,439.16	111,340.83	91,639.89	19,249.34
Amortization of bonds—discount		54,340.00	[5] 4,015.00	
Total	39,439.16	165,680.83	87,624.89	19,249.34
Deduct:				
Interest on General Pipe Line Co. bonds	15,530.17	59,427.94	55,446.75	33,335.34
Dividends received	25,580.00	64,015.00	33,603.50	12,000.00
Total	41,110.17	123,442.94	89,050.25	45,335.34
Net adjustment	1,671.01	42,237.89	1,425.36	26,086.00
Company's income from oil business	396,315.95	3,007,859.77	6,724,753.83	[4] 57,958.78
Additions:				
Impounded funds	197.10	41,698.93		
Nonoperating property expense		1,689.49	1,794.74	543.00
Miscellaneous		5,377.20	24,152.93	26,594.05
Field research				29,783.93
Scouting and leasing		848.27	547.41	2,760.00
Geological		394.86	4,156.02	
Selling expense (Mexico)			18,750.00	56,250.00
Depreciation and depletion adjustment	136,681.41	387,260.98	550,685.67	823,808.09
Abandoned property				136,223.60
Drilling, incidental (California)		332,187.34	294,026.34	275,142.69
Drilling, incidental (Wyoming)				326,056.28
Total	136,878.51	769,457.07	894,113.11	1,677,161.64
Revised income from oil business	533,194.46	3,777,316.84	7,618,866.94	1,619,202.86

[1] Last 6 months.
[2] First 6 months.
[3] Shown on company's records as credit.
[4] Loss.
[5] Deduction.

TABLE 33.—*Balance sheets, Shell Co. of California, as shown by company's records, 1915–June 30, 1919.*

Item.	1915	1916	1917	1918	1919[1]
ASSETS.					
Fixed assets:					
Plant account	$21,390,586.01	$24,778,965.15	$30,299,627.42	$33,010,814.34	$34,166,635.80
Other (patent rights)			1,000,000.00	1,000,000.00	1,000,000.00
Total	21,390,586.01	24,778,965.15	31,299,627.42	34,010,814.34	35,166,635.80
Less depreciation	683,396.61	3,227,304.03	8,260,765.92	12,896,730.54	15,156,427.26
Net fixed assets	20,707,189.40	21,551,661.12	23,038,861.50	21,114,083.80	20,011,208.54
Current assets:					
Cash	516,633.48	1,295,909.55	570,030.44	740,604.33	600,021.63
Accounts receivable	240,096.11	705,856.43	1,520,343.38	2,116,482.56	1,832,632.90
Notes receivable				200,800.00	
Inventory, oil	1,612,859.77	978,356.08	953,375.70	1,362,579.18	2,686,681.94
Inventory, material, etc.	283,494.67	563,678.58	1,262,813.64	2,219,292.33	1,933,633.52
Total	2,653,084.03	3,543,800.64	4,306,563.16	6,639,759.40	7,052,969.99
Deferred charges	127,640.16	107,385.26	55,160.31	106,760.75	99,386.89
Affiliated companies:					
Accounts receivable	331,189.79	2,329,504.85	4,928,429.20	10,947,774.88	11,765,890.77
Stocks and bonds	5,678,375.00	7,257,900.00	4,306,900.00	2,256,900.00	2,256,900.00
Other stocks and bonds	101,548.30		324,250.05	1,284,450.00	1,269,550.00
Other assets	[2] 2,279,800.00	[2] 3,244,440.00			
Total assets	31,878,826.68	38,034,691.87	36,960,164.22	42,299,728.83	42,455,906.19
LIABILITIES.					
Capital stock	25,000,000.00	33,535,575.00	33,535,575.00	33,535,575.00	33,535,575.00
Current liabilities:					
Accounts payable	274,131.62	367,543.29	865,376.98	857,337.70	872,856.10
Notes payable	14,000.00				
Accrued liabilities		86,774.78	279,234.13	143,495.00	
Total	288,131.62	454,318.07	1,144,611.11	1,000,832.70	872,856.10
Intercompany accounts payable	429,318.60	3,025,123.45	1,351,280.34	4,279,181.62	5,046,469.98
Subscription capital stock	5,962,935.00				
Discount stock subsidiary companies	129,700.00	446,625.00			
Reserves	41,127.19	31,796.59	181,305.05		
Surplus	27,614.27	541,253.76	747,392.72	3,484,139.51	3,001,005.11
Total liabilities	31,878,826.68	38,034,691.87	36,960,164.22	42,299,728.83	42,455,906.19

[1] June 30.

[2] Discount on capital stock issued.

TABLE 34.—*Fixed investment by departments, Shell Co. of California, 1915–June 30, 1919.*

Date.	Refining.	Marketing.	Producing.	Pipe lines.[1]
1915	$2,180,163.75	$1,222,236.92	$17,176,634.47	$755,970.37
1916	3,196,282.40	1,531,414.30	19,225,429.94	768,065.54
1917	3,575,035.40	1,896,348.29	22,174,280.10	768,236.75
1918	4,045,536.51	1,939,340.27	23,085,753.91	3,800,296.45
1919[2]	4,267,427.90	2,022,603.92	23,938,287.33	3,798,422.75

Date.	Marine.	Other.	Total.
1915	$55,580.50		$21,390,586.01
1916	57,772.97		24,778,965.15
1917	1,883,726.88	$1,000,000.00	31,299,627.42
1918	139,887.20	1,000,000.00	34,010,814.34
1919[2]	139,893.90	1,000,000.00	35,166,635.80

[1] Including tank farms.

[2] June 30.

TABLE 35.—*Income account, Shell Co. of California, as shown by company's records, 1915–June 30, 1919.*

Item.	1915	1916	1917	1918	1919 [1]
Gross sales of oil	$1,723,380.52	$7,180,907.20	$9,832,062.96	$14,567,174.62	$6,585,506.68
Less—					
Packages					55,214.87
Transportation	109,077.89	290,616.91	459,961.31	426,389.67	347,407.38
Discounts, etc					15,695.42
Marketing expense	725,350.75	1,076,799.43	1,279,685.56	1,917,790.13	989,520.98
Total deductions	834,428.64	1,367,416.34	1,739,646.87	2,344,179.80	1,407,838.65
Net sales at refinery	888,951.88	5,813,490.86	8,092,416.09	12,222,994.82	5,177,668.03
Cost of sales:					
Cost of crude and equivalent		3,382,163.09	6,630,552.26	9,397,312.37	3,746,513.80
Refinery operating		997,944.09	1,249,876.89	1,462,817.21	827,270.12
Purchased products	1,499,825.64	335,081.57	4,719.31	28,215.12	350,201.94
Inventory (increase or decrease)	[2] 396,053.19	565,872.33	[2] 206,134.89	23,415.50	[2] 657,689.38
Total cost of sales	1,103,772.45	5,281,061.08	7,679,013.57	10,911,760.20	4,266,296.48
Profit on oil sold	[2] 214,820.57	532,429.78	413,402.52	1,311,234.62	911,371.55
Other income:					
Oil-producing property	41,765.95	5,677.48	19,370.22		
Pipe lines	46,404.69			1,028,000.53	
Marine	183,700.00	1,497.87	406,654.67		
Tank cars	1,846.70	3,077.04	8,147.86		11,200.02
Other operating	19,094.05		367,261.87		
Dividends					7,672.50
Rents					457,219.31
Miscellaneous	5,045.61	88,505.17		950,222.62	
Gross income	83,036.43	631,187.34	1,214,837.14	3,289,457.77	1,387,463.38
Deductions:					
Income tax			135,050.67		
Other	62,030.17	117,547.85	296,874.25	303,768.72	39,862.95
Total deductions	62,030.17	117,547.85	431,924.92	303,768.72	39,862.95
Net income	21,006.26	513,639.49	782,912.22	2,985,689.05	1,347,600.43

[1] First 6 months. [2] Decrease. [3] Loss.

TABLE 36.—*Company's net and Commission's revised investment in petroleum business, Shell Co. of California, 1915–June 30, 1919.*

Item.	1915	1916	1917	1918	1919 [1]
Company's investment:					
Capital stock	$30,962,935.00	$33,535,575.00	$33,535,575.00	$33,535,575.00	$33,535,575.00
Surplus	[2] 2,252,185.73	[2] 2,703,186.24	747,392.72	3,484,139.51	3,001,005.11
Company's entire business	28,710,749.27	30,832,388.76	34,282,967.72	37,019,714.51	36,536,580.11
Deduct:					
Net stocks and bonds affiliated companies	5,507,547.81	6,779,478.41	4,306,900.00	2,256,900.00	2,256,900.00
Government and other investment	101,548.30		142,945.00	1,234,450.00	1,269,550.00
Net accounts receivable affiliated companies	[3] 112,128.81	[3] 695,618.60	3,577,148.86	6,668,593.26	6,719,420.79
Total deductions	5,496,967.30	6,083,859.81	8,026,993.86	10,159,943.26	10,245,870.79
Company investment in oil business	23,213,781.97	24,748,528.95	26,255,973.86	26,859,771.25	26,290,709.32

[1] June 30. [2] Deficit. [3] Addition.

TABLE 36.—*Company's net and Commission's revised investment in petroleum business, Shell Co. of California, 1915–June 30, 1919*—Continued.

Item.	1915	1916	1917	1918	1919
Deduct:					
Deferred charges	$127,640.16	$107,385.26	$55,160.31	$106,760.75	$99,386.89
Depreciation and depletion adjustment	741,293.36				
Patent right			900,000.00	800,000.00	750,000.00
Marine investment [4]			1,057,992.19		
Other investment				200,800.00	248,193.44
Total deductions	868,933.52	107,385.26	2,013,152.50	1,107,560.75	1,097,580.33
Add:					
Depreciation and depletion adjustment		74,833.78	2,938,516.44	4,969,445.05	5,958,106.69
Geological expense	15,145.81	34,711.81	63,889.69	104,102.92	129,277.52
Investigational expense			48,891.54	59,902.80	59,902.80
Total additions	15,145.81	109,545.59	3,051,297.67	5,133,450.77	6,147,287.01
Net addition	[5] 853,787.71	2,160.33	1,038,145.17	4,025,890.02	5,049,706.68
Revised investment	22,359,994.26	24,750,689.28	27,294,119.03	30,885,661.27	31,340,416.00

[4] Excluded from investment in the petroleum business, as this item appears only 1 year.
[5] Deductions.

TABLE 37.—*Company's income and Commission's revised income from petroleum business, Shell Co. of California, 1915–June 30, 1919.*

Item.	1915	1916	1917	1918	1919 [1]
Company's income	$21,006.26	$513,639.49	$782,912.22	$2,985,689.05	$1,347,600.43
Add income tax			135,050.67		
Company's income, entire business	21,006.26	513,639.49	917,962.89	2,985,689.05	1,347,600.43
Deduct:					
Interest affiliated companies	3,214.68	37,309.83	263,883.69	547,763.12	
Marine income [2]			406,654.67		
Dividends		15,345.00	15,345.00	15,345.00	7,672.50
Simplex royalty			58,264.61	8,718.69	
Total	3,214.68	52,654.83	744,147.97	571,826.81	7,672.50
Company's income, oil business	17,791.58	460,984.66	173,814.92	2,413,862.24	1,339,927.93
Add:					
Depreciation and depletion adjustment	[3] 741,293.36	816,127.14	2,863,682.66	2,030,928.61	988,661.64
Geological	15,145.81	19,566.00	29,177.88	40,213.23	25,174.60
Investigational			48,891.54	11,011.26	
Abandoned property			195,751.89	1,424,542.77	
Patent depreciation			100,000.00	100,000.00	50,000.00
Total additions	[3] 726,147.55	835,693.14	3,237,503.97	3,606,695.87	1,063,836.24
Less Valley Pipe Line charge				333,515.22	
Net additions	[3] 726,147.55	835,693.14	3,237,503.97	3,273,180.65	1,063,836.24
Revised income, oil business	[4] 708,355.97	1,296,677.80	3,411,318.89	5,687,042.89	2,403,764.17

[1] First 6 months.
[2] Excluded from petroleum business as this item appears only 1 year.
[3] Deduction.
[4] Loss.

TABLE 38.—*Principal items of cost of producing crude petroleum, as revised by the Commission, by groups of producers, 1914–June 30, 1919.*

Year.	Group.	Range of production (barrels).	Number of companies.	Quantity (barrels).	Cost of production.					
					Lifting.	General and administrative.	Depreciation.	Depletion.	Credits.[1]	Total.
1914	1	Over 1,000,000	10	45,942,546	$2,266,312.55	$2,129,840.40	$3,075,208.63	$3,163,447.38	$219,839.57	$10,414,969.39
	2	250,000 to 1,000,000	18	9,207,863	945,154.17	306,645.41	733,557.41	449,655.44	10,407.08	2,424,605.35
	3	50,000 to 250,000	38	3,802,888	651,087.52	171,772.02	407,464.08	459,555.20	1,620.63	1,688,258.19
	4	Under 50,000	30	867,630	208,525.93	51,995.67	158,670.20	167,086.10		586,277.90
		Total	96	59,820,927	4,071,080.17	2,660,253.50	4,374,900.32	4,239,744.12	231,867.28	15,114,110.83
1915	1	Over 1,000,000	7	39,446,324	2,098,286.87	2,016,584.04	3,161,928.32	3,055,232.30	261,092.25	10,070,939.28
	2	250,000 to 1,000,000	20	10,572,668	931,773.90	335,695.08	833,751.66	556,998.72	22,265.96	2,635,953.40
	3	50,000 to 250,000	35	3,923,381	552,162.97	165,295.31	453,714.46	349,819.29	1,444.34	1,519,547.69
	4	Under 50,000	45	1,263,968	316,059.05	139,526.79	298,503.58	398,500.97	32.91	1,152,557.48
		Total	107	55,206,341	3,898,282.79	2,657,101.22	4,747,898.02	4,360,551.28	284,835.46	15,378,997.85
1916	1	Over 1,000,000	9	49,261,293	3,344,968.98	2,904,790.88	3,810,714.16	3,926,535.90	406,150.11	13,580,859.81
	2	250,000 to 1,000,000	19	8,879,891	1,034,731.36	337,158.25	797,508.52	569,593.24	21,521.73	2,717,469.64
	3	50,000 to 250,000	43	4,650,122	902,094.99	273,430.03	567,691.39	499,393.82	8,809.60	2,233,800.63
	4	Under 50,000	45	1,215,086	334,326.49	87,822.26	271,663.39	377,589.91	30.82	1,071,371.23
		Total	116	64,006,392	5,616,121.82	3,603,201.42	5,447,577.46	5,373,112.87	436,512.26	19,603,501.31
1917	1	Over 1,000,000	10	58,823,426	5,321,956.25	3,913,711.68	5,355,783.64	4,338,060.63	734,752.52	18,194,759.68
	2	250,000 to 1,000,000	19	9,255,178	1,365,947.78	409,186.47	825,917.67	556,144.14	14,905.30	3,142,290.76
	3	50,000 to 250,000	49	5,501,353	1,315,441.41	366,108.68	768,226.36	695,863.26	6,603.44	3,139,036.27
	4	Under 50,000	53	1,225,195	422,547.70	124,275.49	298,456.93	373,395.20	932.36	1,217,742.96
		Total	131	74,805,152	8,425,893.14	4,813,282.32	7,248,384.60	5,963,463.23	757,193.62	25,693,829.67
1918	1	Over 1,000,000	10	63,202,366	6,663,665.65	5,280,915.29	6,140,133.09	4,514,358.69	938,380.07	21,660,692.65
	2	250,000 to 1,000,000	22	10,541,776	1,931,985.47	682,011.37	1,109,667.91	648,968.10	19,359.01	4,353,273.84
	3	50,000 to 250,000	47	5,635,917	1,630,380.06	513,399.02	799,773.06	610,545.62	7,726.57	3,546,371.19
	4	Under 50,000	55	1,305,056	563,289.61	154,892.78	327,288.72	384,612.18	3,828.71	1,426,254.58
		Total	134	80,685,115	10,789,320.79	6,631,218.46	8,376,862.78	6,158,484.59	969,294.36	30,986,592.26
1919[2]	1	Over 1,000,000	11	33,383,864	4,378,786.19	3,282,454.64	3,360,015.78	2,332,896.59	507,397.96	12,846,755.24
	2	250,000 to 1,000,000	22	4,911,694	1,053,190.28	335,691.24	564,626.16	289,140.87	14,007.85	2,228,640.70
	3	50,000 to 250,000	39	2,254,639	733,057.27	224,858.24	310,767.16	268,966.91	3,186.38	1,534,463.20
	4	Under 50,000	47	568,709	235,381.38	77,479.37	148,796.95	174,758.34	377.33	636,038.71
		Total	119	41,118,906	6,400,415.12	3,920,483.49	4,384,206.05	3,065,762.71	524,969.52	17,245,897.85

[1] Deduction.

[2] First 6 months.

TABLE 39.—*Lifting cost and total cost, per barrel of 42 gallons, of producing crude petroleum in California, by companies, 1914.*

Company.	Lifting cost.	Total cost.	Per cent of production covered.	Company.	Lifting cost.	Total cost.	Per cent of production covered.	Company.	Lifting cost.	Total cost.	Per cent of production covered.
1	$0.018	$0.031	.....	33	$0.125	$0.351	.....	65	$0.208	$0.562	.....
2	.010	.038	.....	34	.195	.354	.....	66	.227	.568	.....
3	.058	.124	.....	35	.076	.358	.....	67	.190	.577	.....
4	.086	.153	.....	36	.170	.363	.....	68	.219	.590	.....
5	.086	.165	29.8	37	.215	.365	.....	69	.310	.623	.....
6	.102	.169	.....	38	.050	.372	80.1	70	.255	.655	.....
7	.025	.170	.....	39	.263	.374	.....	71	.217	.691	97.9
8	.102	.172	.....	40	.218	.379	.....	72	.242	.700	.....
9	.025	.178	.....	41	.117	.386	.....	73	.106	.701	.....
10	.092	.190	.....	42	.075	.398	.....	74	.136	.706	.....
11	.097	.191	.....	43	.128	.401	.....	75	.224	.710	.....
12	.052	.246	49.3	44	.179	.403	.....	76	.263	.746	.....
13	.088	.248	.....	45	.157	.419	.....	77	.250	.777	.....
14	.078	.248	.....	46	.124	.421	.....	78	.471	.781	.....
15	.060	.249	.....	47	.200	.421	.....	79	.397	.790	.....
16	.070	.249	.....	48	.154	.422	.....	80	.361	.799	.....
17	.107	.254	.....	49	.037	.423	87.3	81	.469	.805	.....
18	.181	.254	.....	50	.087	.445	.....	82	.246	.811	.....
19	.126	.256	.....	51	.081	.453	.....	83	.333	.878	99.0
20	.168	.263	.....	52	.162	.457	95.4	84	.255	.882	.....
21	.132	.264	.....	53	.290	.463	.....	85	.355	.889	.....
22	.087	.273	.....	54	.064	.471	.....	86	.167	.939	.....
23	.127	.277	.....	55	.252	.483	.....	87	.144	.942	.....
24	.158	.288	58.9	56	.097	.487	.....	88	.235	.971	.....
25	.056	.292	.....	57	.074	.519	.....	89	.193	.980	.....
26	.082	.296	.....	58	.125	.521	.....	90	.721	1.232	.....
27	.045	.301	.....	59	.165	.533	.....	91	.419	1.330	.....
28	.172	.318	.....	60	.254	.542	.....	92	.142	1.745	.....
29	.120	.321	69.8	61	.230	.548	.....	93	.204	1.751	.....
30	.150	.326	.....	62	.222	.554	.....	94	.247	1.786	.....
31	.145	.339	.....	63	.219	.558	.....	95	.241	1.821	.....
32	.188	.339	.....	64	.164	.562	.....	96	.446	1.961	100.0

TABLE 40.—*Cost of producing crude petroleum in California, by fields, 1914–June 30, 1919.*

Year.	Field.	Quantity.	Quantity per company.	Annual production per well.	Production cost per barrel.							
					Lifting expense.	General and administrative.	Depreciation.	Depletion.	Credits.	Total.	Royalty.	Grand total.
		Barrels.	*Barrels.*	*Barrels.*								
1914	Coalinga	3,372,406	187,356	15,470	$0.175	$0.032	$0.114	$0.095	$0.002	$0.414	$0.008	$0.422
	Kern River	1,173,072	90,236	4,547	.170	.03	.117	.082	.001	.406	.024	.430
	Los Angeles and Salt Lake	1,086,821	271,705	7,245	.104	.028	.119	.053	.....	.304	.062	.366
	Midway-Sunset	12,419,816	413,661	34,499	.069	.035	.052	.122	.....	.278	.021	.299
	McKittrick	658,343	164,586	15,310	.108	.019	.065	.090	.....	.282	.....	.282
	Santa Maria	613,833	204,611	12,036	.110	.033	.177	.069	.001	.388	.037	.425
	Ventura-Newhall	383,313	127,771	4,914	.095	.061	.128	.148	.....	.432	.055	.487
	Whittier-Fullerton	1,840,956	262,994	8,563	.082	.037	.090	.069	.002	.276	.039	.315
	Nonseparable [1]	38,272,367	2,733,741	28,100	.052	.050	.071	.051	.006	.218	.020	.238
	Total	59,820,927	623,135	21,872	.068	.045	.073	.071	.004	.253	.021	.274
1915	Coalinga	2,709,301	142,595	12,015	.157	.032	.142	.119	.....	.450	.007	.457
	Kern River	1,002,811	77,142	3,607	.154	.045	.136	.096	.001	.430	.022	.452
	Los Angeles and Salt Lake	884,941	221,235	5,932	.123	.034	.145	.058	.....	.360	.073	.433
	Midway-Sunset	8,319,885	259,996	21,808	.089	.061	.084	.187	.....	.421	.020	.441
	McKittrick	560,791	140,198	13,042	.103	.020	.077	.107	.....	.307	.....	.307
	Santa Maria	914,444	228,611	14,749	.083	.031	.140	.082	.....	.336	.033	.369
	Ventura-Newhall	536,826	107,325	5,899	.123	.060	.135	.133	.....	.451	.054	.505
	Whittier-Fullerton	1,820,356	260,051	8,312	.095	.042	.093	.070	.012	.288	.036	.324
	Nonseparable [1]	38,486,956	2,025,629	25,830	.054	.048	.078	.052	.007	.225	.021	.246
	Total	55,236,341	516,227	18,794	.070	.048	.086	.079	.005	.278	.024	.302
1916	Coalinga	7,405,951	336,634	18,107	.130	.042	.079	.156	.....	.407	.003	.410
	Kern River	1,062,200	75,871	3,329	.203	.048	.130	.092	.001	.472	.043	.515
	Los Angeles and Salt Lake	745,669	186,417	5,143	.136	.015	.162	.069	.....	.412	.083	.495
	Midway-Sunset	7,836,357	267,768	18,504	.125	.066	.095	.199	.....	.485	.039	.524
	McKittrick	788,157	157,631	16,950	.096	.023	.060	.076	.....	.255	.....	.255
	Santa Maria	944,060	188,812	13,971	.162	.048	.172	.197	.001	.578	.047	.625
	Ventura-Newhall	582,298	97,049	5,852	.166	.083	.164	.129	.....	.542	.064	.606
	Whittier-Fullerton	1,617,444	259,635	7,237	.111	.050	.110	.078	.010	.339	.041	.380
	Nonseparable [1]	43,024,256	2,151,213	25,771	.066	.058	.079	.048	.010	.241	.024	.265
	Total	64,006,392	551,779	18,798	.088	.056	.085	.084	.007	.306	.027	.333

[1] Includes results for companies operating in two or more fields.

TABLE 40.—*Cost of producing crude petroleum in California, by fields, 1914–June 30, 1919*—Continued.

Year.	Field.	Quantity.	Quantity per company.	Annual production per well.	Production cost per barrel.							
					Lifting expense.	General and administrative.	Depreciation.	Depletion.	Credits.	Total.	Royalty.	Grand total.
		Barrels.	*Barrels.*	*Barrels.*								
1917	Coalinga	8,953,884	373,079	18,830	$0.128	$0.046	$0.106	$0.117	.....	$0.397	$0.012	$0.409
	Kern River	998,490	71,321	3,040	.276	.078	.143	.100	$0.001	.596	.052	.648
	Los Angeles and Salt Lake	640,345	160,086	4,657	.206	.062	.189	.080	.....	.537	.109	.646
	Midway-Sunset	8,680,512	248,015	16,758	.160	.075	.098	.188	.....	.521	.056	.577
	McKittrick	917,712	114,714	16,101	.127	.022	.065	.072	.....	.286	.....	.286
	Santa Maria	1,164,406	166,344	14,928	.200	.063	.165	.198	.001	.625	.069	.694
	Ventura-Newhall	590,205	73,776	5,568	.186	.107	.211	.135	.001	.638	.073	.711
	Whittier-Fullerton	1,546,533	220,933	6,951	.138	.058	.116	.081	.002	.391	.054	.445
	Nonseparable [1]	51,313,065	2,138,044	21,082	.094	.066	.090	.051	.014	.287	.030	.317
	Total	74,805,152	571,032	17,358	.112	.064	.097	.080	.010	.343	.036	.379
1918	Coalinga	9,520,211	366,162	17,184	.148	.058	.115	.109	.....	.430	.011	.441
	Kern River	982,963	70,212	2,862	.381	.077	.147	.096	.001	.700	.056	.756
	Los Angeles and Salt Lake	563,251	140,813	4,251	.257	.067	.200	.094	.....	.618	.124	.742
	Midway-Sunset	9,267,093	243,871	15,381	.206	.085	.107	.180	.001	.577	.075	.652
	McKittrick	908,937	129,848	11,362	.197	.033	.078	.072	.....	.380	.....	.380
	Santa Maria	1,525,729	217,961	17,240	.233	.078	.159	.157	.003	.624	.084	.708
	Ventura-Newhall	917,380	101,931	8,154	.180	.105	.199	.101	.005	.580	.063	.643
	Whittier-Fullerton	2,324,668	258,297	9,956	.151	.064	.103	.064	.....	.382	.056	.438
	Nonseparable [1]	54,674,883	2,733,744	15,680	.108	.087	.097	.050	.017	.325	.040	.365
	Total	80,685,115	602,128	14,321	.134	.082	.101	.076	.012	.384	.044	.428
1919 [2]	Coalinga	4,717,065	214,412	.....	.157	.067	.120	.109	.....	.453	.014	.467
	Kern River	449,978	44,998	.....	.345	.067	.131	.081	.001	.623	.053	.676
	Los Angeles and Salt Lake	268,784	67,196	.....	.299	.077	.212	.099	.....	.687	.137	.824
	Midway-Sunset	4,012,863	118,025	.....	.238	.106	.127	.202	.....	.673	.061	.734
	McKittrick	401,562	66,927	.....	.183	.042	.084	.060	.004	.365	.....	.365
	Santa Maria	373,676	74,735	.....	.364	.089	.128	.266	.002	.845	.087	.932
	Ventura-Newhall	558,553	62,061	.....	.192	.088	.176	.083	.010	.529	.067	.596
	Whittier-Fullerton	1,318,258	146,473	.....	.156	.056	.098	.056	.....	.366	.050	.416
	Nonseparable [1]	29,018,167	1,450,908	.....	.136	.102	.099	.050	.018	.369	.042	.411
	Total	41,118,906	213,850	.....	.156	.095	.107	.074	.013	.419	.044	.463

[1] Includes results for companies operating in two or more fields.

[2] First 6 months.

TABLE 41.—*Prices of principal materials and supplies used in drilling operations in California, July 1, 1914, to Jan. 1, 1920.*

Article.	Delivered prices.						Percentages of increase over July 1, 1914.				
	July 1, 1914.	July 1, 1916.	July 1, 1917.	July 1, 1918.	July 1, 1919.	Jan. 1, 1920.	July 1, 1916.	July 1, 1917.	July 1, 1918.	July 1, 1919.	Jan. 1, 1920.
Bit steel per pound	$0.036	$0.048	$0.07	$0.07	$0.07	$0.10	33.33	94.44	94.44	94.44	177.88
Bailers:											
5¼ by 20, each	26.91	35.73	52.17	57.28	59.27	58.73	32.78	93.87	112.86	120.25	110.81
8 by 19, each	45.50	57.22	66.86	78.49	92.69	94.94	25.76	46.95	72.51	103.71	108.66
8 by 20, each	44.48	53.63	76.05	84.89	94.34	96.22	20.57	70.98	90.85	112.10	116.32
8 by 30, each	66.72	105.94	116.83	136.48	148.63	141.07	58.78	75.10	104.56	122.77	111.44
Casing:											
5-⅜ inch—17 pounds, per foot	.557	.727	1.05	1.25	1.13	1.13	30.52	88.51	124.42	102.87	102.87
6⅝-inch—17 pounds, per foot	.594	.752	1.06	1.26	1.14	1.14	26.60	78.45	112.12	91.92	91.92
6⅝-inch—20 pounds, per foot	.698	.893	1.272	1.49	1.355	1.358	27.94	82.23	113.47	94.13	94.56
8¼-inch—17½ pounds, per foot	.695	.89	1.217	1.42	1.30	1.30	28.06	75.11	104.32	87.05	87.05
8¼-inch—28 pounds, per foot	.988	1.315	1.843	2.14	1.955	1.943	33.10	86.54	116.60	97.87	96.66
10-inch—35 pounds, per foot	1.203	1.577	2.21	2.60	2.37	2.37	31.09	83.71	116.13	97.01	97.01
12½-inch—50 pounds, per foot	1.97	2.453	3.453	4.013	3.70	3.68	24.52	75.28	103.71	87.82	86.80
15½-inch—52½ pounds, per foot	2.57	3.04	3.67	4.51	4.17	4.17	18.29	42.80	75.49	62.26	62.26
15-inch—70 pounds, per foot	3.484	4.185	6.015	6.26	5.795	5.795	20.12	72.65	79.68	66.33	66.33
Drive pipe, 8-inch—32 pounds, per foot	1.153	1.46	2.15	2.51	2.297	2.297	26.63	86.47	117.69	99.22	99.22
Tubing:											
2-inch—4 pounds, per foot	.145	.19	.265	.3117	.2842	.2842	31.03	82.76	114.97	96.00	96.00
2-inch—4½ pounds, per foot	.1608	.2108	.2992	.35	.32	.32	31.09	86.07	117.66	99.00	99.00
3-inch—8½ pounds, per foot	.2833	.3558	.5367	.63	.5725	.5725	25.59	89.45	122.38	102.08	102.08
Line pipe, 2-inch, oil line, per foot	.12	.175	.2275	.27	.245	.245	45.83	89.58	125.00	104.17	104.17
Sucker rods, ⅞-inch, per 100 feet	14.25	15.38	19.58	20.93	18.24	20.44	7.93	37.40	46.88	28.00	43.44
Horn sockets, 6½-inch, each	41.30	57.75	66.60	78.75	78.75	72.00	39.83	61.26	90.68	90.68	74.33
Rig irons, 5-inch, D. T. (not including rig or calf wheels)	504.33	595.55	829.77	1,079.50	1,079.50	1,120.71	18.09	64.53	114.05	114.05	122.22
Drilling stem pins, 2½ by 3½ inch	6.38	10.80	13.18	18.60	18.60	19.29	69.28	106.58	191.54	191.54	202.35
Wire cables:											
⅜-inch, 6 strands, 19 wire	.0825	.136	.181	.1833	.1723	.165	64.85	119.39	122.18	108.85	100.09
½-inch	.1085	.1721	.241	.239	.222	.2096	58.62	122.12	120.28	104.61	93.18
Manila cable, per pound	.1525	.2225	.3431	.3856	.2956	.2661	45.90	124.98	152.85	93.84	74.49
Pumps:											
3 by 2 by 3, Duplex	36.80	45.57	57.95	70.30	62.65	64.801	23.83	57.47	91.03	70.24	76.09
6 by 4 by 6, Duplex	94.13	112.68	144.33	170.64	156.31	161.80	19.71	53.33	81.28	66.06	71.89
Pump jacks, 3-inch beam, each	34.20	39.00	54.21	60.37	57.18	62.99	14.04	58.51	76.52	67.19	84.18
Rig timber, per 1,000 feet	26.19	29.00	35.88	41.50	52.60	57.75	10.73	37.00	58.46	100.84	120.50
Steel tanks, 55,000 barrels, each	16,667.00	21,653.00	36,667.00	37,967.00	34,233.00	36,743.00	29.92	120.00	127.80	105.39	120.45

TABLE 41.—*Prices of principal materials and supplies used in drilling operations in California, July 1, 1914, to Jan. 1, 1920*—Continued.

Article.	Delivered prices.						Percentages of increase over July 1, 1914.				
	July 1, 1914.	July 1, 1916.	July 1, 1917.	July 1, 1918.	July 1, 1919.	Jan. 1, 1920.	July 1, 1916.	July 1, 1917.	July 1, 1918.	July 1, 1919.	Jan. 1, 1920.
Gas engines:											
25-horsepower, each	$750.00	$826.33	$902.00	$988.00	$1,483.33	$1,344.67	10.18	20.27	31.73	97.78	79.29
40-horsepower, each	.....	900.00	1,792.75	2,195.00	2,023.33	1,956.46	.....	99.19	143.89	124.81	117.38
Steam engines:											
25-horsepower, 11 by 12	325.13	358.87	454.73	541.70	679.55	691.20	10.38	39.86	66.61	109.01	112.59
30-horsepower, 12 by 12	360.64	368.16	480.95	589.60	698.05	748.51	2.09	33.36	63.49	93.56	107.55
Boilers:											
40-horsepower	680.00	685.00	1,000.00	1,970.00	1,970.00	1,900.00	.74	47.06	189.71	189.71	179.41
50-horsepower	1,000.00	1,040.00	1,965.00	1,970.00	1,970.00	1,970.00	4.00	96.50	97.00	97.00	97.00
70-horsepower	725.00	750.00	1,250.00	1,975.00	1,975.00	1,975.00	3.45	72.42	172.41	172.41	172.41
Band wheel, Powers Mascot, No. 8	500.00	563.49	640.99	850.48	936.74	1,054.75	12.70	28.20	70.10	87.35	110.95

TABLE 42.—*Production, investment, earnings, and rate of earnings in the producing business, by profit groups, 1914–June 30, 1919.*

Profit group.	Companies.		Net production.		Net investment.		Earnings.		Annual rate of earnings (per cent).
	Number.	Per cent.	Barrels.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	
1914:									
Losing money	47	48.9	10,037,253	17.9	$64,316,108	42.9	[1] $1,135,399	[1] 9.9	[1] 1.8
Earning less than 10 per cent	29	30.2	15,209,243	27.1	47,472,112	31.7	2,156,864	18.9	4.5
Earning 10 to 20 per cent	9	9.4	3,175,274	5.6	6,285,819	4.2	881,401	7.7	14.0
Earning 20 to 30 per cent	5	5.2	23,824,101	42.5	30,439,137	20.3	8,108,221	71.0	26.7
Earning 30 to 40 per cent	2	2.1	376,481	.7	211,345	.1	68,989	.6	32.7
Earning 40 to 50 per cent	2	2.1	1,003,535	1.8	714,814	.5	333,209	2.9	46.6
Earning 50 per cent and over	2	2.1	2,469,603	4.4	432,531	.3	998,450	8.8	230.9
Total	96	100.0	56,095,490	100.0	149,871,866	100.0	11,411,735	100.0	7.6
1915:									
Losing money	60	56.1	11,270,308	21.7	66,774,271	44.0	[1] 1,643,309	[1] 24.4	[1] 2.5
Earning less than 10 per cent	30	28.1	14,673,524	28.3	48,845,788	32.2	1,861,359	27.6	3.8
Earning 10 to 20 per cent	9	8.4	13,423,723	25.9	23,180,350	15.2	3,299,637	49.0	14.2
Earning 20 to 30 per cent	4	3.7	10,379,936	20.0	11,890,441	7.8	2,692,368	39.9	22.6
Earning 30 to 40 per cent	2	1.9	1,206,434	2.3	717,615	.5	279,806	4.2	39.0
Earning 40 to 50 per cent	1	.9	567,647	1.1	314,445	.2	133,308	2.0	42.4
Earning 50 per cent and over	1	.9	361,628	.7	139,250	.1	117,136	1.7	84.1
Total	107	100.0	51,883,200	100.0	151,862,160	100.0	6,740,305	100.0	4.4
1916:									
Losing money	59	50.9	5,169,925	8.6	39,312,004	22.7	[1] 1,230,681	[1] 5.7	[1] 3.1
Earning less than 10 per cent	29	25.0	17,961,704	29.9	68,160,401	39.4	3,961,808	18.5	5.8
Earning 10 to 20 per cent	11	9.5	11,573,456	19.3	29,685,270	17.2	4,463,754	20.8	15.0
Earning 20 to 30 per cent	7	6.0	14,069,277	23.4	23,678,450	13.7	6,407,667	29.9	27.1
Earning 30 to 40 per cent	2	1.7	251,423	.4	460,197	.3	146,714	.7	31.9
Earning 40 to 50 per cent	3	2.6	1,143,798	1.9	917,981	.5	418,617	1.9	45.6
Earning 50 per cent and over	5	4.3	9,952,898	16.5	10,723,888	6.2	7,257,541	33.9	67.7
Total	116	100.0	60,122,481	100.0	172,938,191	100.0	21,425,420	100.0	12.4
1917:									
Losing money	42	32.1	5,455,515	7.8	37,129,488	18.0	[1] 1,121,755	[1] 2.9	[1] 3.0
Earning less than 10 per cent	37	28.3	3,524,586	5.0	24,888,631	12.0	1,144,450	2.9	4.6
Earning 10 to 20 per cent	24	18.3	22,208,925	31.8	73,522,597	35.5	10,617,132	27.4	14.4
Earning 20 to 30 per cent	8	6.1	10,297,795	14.8	27,673,151	13.4	6,424,117	16.6	23.2
Earning 30 to 40 per cent	8	6.1	16,684,496	23.9	30,051,920	14.5	11,578,849	29.9	38.5

[1] Loss.

TABLE 42.—*Production, investment, earnings, and rate of earnings in the producing business, by profit groups, 1914–June 30, 1919*—Continued.

Profit group.	Companies.		Net production.		Net investment.		Earnings.		Annual rate of earnings (per cent).
	Number.	Per cent.	Barrels.	Per cent.	Amount.	Per cent.	Amount.	Per cent.	
1917—Continued.									
Earning 40 to 50 per cent	2	1.5	585,800	0.8	$570,900	0.3	$274,483	0.7	48.1
Earning 50 per cent and over	10	7.6	11,070,724	15.9	13,006,033	6.3	9,856,303	25.4	75.8
Total	131	100.0	69,827,841	100.0	206,842,720	100.0	38,773,579	100.0	18.8
1918:									
Losing money	28	20.9	1,183,932	1.6	11,019,610	4.8	[1] 479,833	[1] .9	[1] 4.4
Earning less than 10 per cent	34	25.4	4,355,068	5.8	37,530,275	16.4	1,009,581	1.8	2.7
Earning 10 to 20 per cent	25	18.6	14,394,448	19.3	60,449,804	26.4	8,671,272	15.6	14.3
Earning 20 to 30 per cent	19	14.2	16,674,471	22.4	52,361,073	22.9	12,830,964	23.0	24.5
Earning 30 to 40 per cent	8	6.0	5,326,267	7.1	13,626,569	6.0	4,911,584	8.8	36.0
Earning 40 to 50 per cent	6	4.5	9,586,443	12.9	15,010,623	6.6	7,153,177	12.9	47.7
Earning 50 per cent and over	14	10.4	23,072,185	30.9	38,747,748	16.9	21,627,518	38.8	55.8
Total	134	100.0	74,582,814	100.0	228,745,702	100.0	55,724,263	100.0	24.4
1919: [2]									
Losing money	21	17.6	469,721	1.2	9,107,393	3.9	[1] 234,165	[1] .8	[1] 5.1
Earning less than 10 per cent	30	25.2	1,368,905	3.6	30,199,577	12.8	406,202	1.3	2.7
Earning 10 to 20 per cent	25	21.0	8,574,318	22.5	74,404,846	31.6	4,920,562	15.7	13.2
Earning 20 to 30 per cent	12	10.1	942,887	2.5	5,636,019	2.4	649,386	2.1	23.0
Earning 30 to 40 per cent	12	10.1	9,402,367	24.7	57,729,689	24.5	9,112,402	29.0	31.6
Earning 40 to 50 per cent	2	1.7	208,504	.6	827,172	.4	190,218	.6	46.0
Earning 50 per cent and over	17	14.3	17,105,451	44.9	57,493,645	24.4	16,352,273	52.1	56.9
Total	119	100.0	38,072,153	100.0	235,398,341	100.0	31,398,878	100.0	26.7
1914–June 30, 1919:									
Losing money	43	36.6	31,655,725	9.0	227,658,874	19.9	[1] 5,845,141	[1] 3.5	[1] 2.6
Earning less than 10 per cent	31	26.9	59,023,959	16.9	257,096,784	22.4	10,542,264	6.4	4.4
Earning 10 to 20 per cent	17	14.6	73,340,144	20.9	267,528,686	23.4	32,853,758	19.8	14.3
Earning 20 to 30 per cent	9	7.8	76,188,467	21.7	151,678,270	13.2	37,112,723	22.4	24.9
Earning 30 to 40 per cent	6	4.8	33,247,468	9.5	102,797,336	9.0	26,098,344	15.8	35.3
Earning 40 to 50 per cent	3	2.3	13,095,727	3.7	18,355,935	1.6	8,503,011	5.1	47.4
Earning 50 per cent and over	8	7.0	64,032,489	18.3	120,543,095	10.5	56,209,222	34.0	61.2
Total	117	100.0	350,583,979	100.0	1,145,658,980	100.0	165,474,181	100.0	16.1

[1] Loss.

[2] First six months.

TABLE 43.—*Cost, net earnings, and investment per barrel based on production and rate of earnings on investment for petroleum producers in California, by companies, 1918.*

No. of company.	Field.	Annual production per well.	Average cost per barrel.	Net earnings per barrel.	Average investment per barrel.	Rate of earnings.
		Barrels.				*Per cent.*
1	Whittier-Fullerton	260,148	$0.140	$1.038	$0.83	124.7
2	Midway-Sunset	2,975	.225	.919	1.44	63.8
3	McKittrick	15,462	.244	1.005	1.06	95.1
4	Midway-Sunset	24,404	.245	1.360	1.05	129.5
5	Ventura-Newhall	103,547	.250	1.080	1.62	63.7
6	Non-Separable	16,071	.261	.759	1.55	48.2
7	Kern River	3,392	.281	.839	1.44	58.3
8	Midway-Sunset	14,099	.291	.733	1.31	56.1
9	Non-Separable	27,763	.296	.955	1.80	53.0
10	Non-Separable	23,831	.305	.857	2.51	34.2
11	Non-Separable	9,247	.320	.424	.93	45.7
12	Midway-Sunset	20,651	.328	.655	2.96	22.1
13	Whittier-Fullerton	10,238	.331	.957	4.68	20.5
14	Coalinga	25,783	.351	.828	2.89	28.6
15	McKittrick	15,446	.357	.854	1.86	45.9
16	Non-Separable	11,094	.367	.435	2.48	17.6
17	Non-Separable	10,191	.388	.950	2.29	41.5
18	Coalinga	6,207	.412	.747	.70	107.3
19	Whittier-Fullerton	14,062	.419	.762	1.34	56.9
20	Non-Separable	13,158	.420	.645	1.56	41.4
21	Non-Separable	19,554	.422	.727	3.25	22.4
22	McKittrick	11,066	.422	.707	1.53	46.3
23	Non-Separable	5,129	.449	.731	3.60	20.3
24	Midway-Sunset	5,772	.450	.718	1.89	38.0
25	Non-Separable	8,992	.454	.700	4.52	15.5
26	Non-Separable	13,322	.459	.818	.93	88.2
27	Midway-Sunset	6,748	.461	.681	1.10	62.1
28	Midway-Sunset	12,409	.468	.941	2.74	34.3
29	Coalinga	13,692	.470	.674	6.50	10.4
30	Non-Separable	10,461	.485	.235	3.30	7.1
31	Santa Maria	42,632	.486	[1].074	3.30	[1]2.2
32	Coalinga	20,393	.489	.639	4.08	15.7
33	Midway-Sunset	44,219	.489	.466	2.50	18.7
34	Midway-Sunset	16,338	.497	1.008	2.66	37.8
35	Non-Separable	11,879	.501	.640	1.09	58.8
36	Non-Separable	6,854	.509	.739	14.61	5.1
37	Non-Separable	8,494	.532	.595	4.08	14.6
38	Los Angeles	6,938	.560	.318	1.47	21.7
39	Midway-Sunset	5,585	.561	.439	3.96	11.1
40	Ventura-Newhall	5,442	.568	.883	4.38	20.2
41	Midway-Sunset	4,605	.569	.555	3.47	16.0
42	Non-Separable	7,986	.583	.808	3.23	25.0
43	Kern River	2,156	.584	.570	5.21	10.9
44	Midway-Sunset	45,671	.589	.552	3.01	18.4
45	Santa Maria	14,256	.595	.849	2.73	31.1
46	Midway-Sunset	74,252	.601	.831	.93	89.5
47	Kern River	6,013	.606	.462	3.93	11.8
48	Midway-Sunset	7,120	.608	.529	1.80	29.3
49	Midway-Sunset	6,665	.611	.553	1.69	32.7
50	Non-Separable	5,665	.635	.392	1.69	23.2
51	Santa Maria	16,306	.635	[1].243	4.84	[1]5.0
52	Midway-Sunset	11,669	.641	.585	6.41	9.1
53	Midway-Sunset	16,645	.651	.576	1.94	29.7
54	Non-Separable	8,281	.660	.496	4.41	11.3
55	Midway-Sunset	6,064	.674	.664	2.94	22.3
56	Ventura-Newhall	121,527	.677	.602	14.72	4.1
57	Midway-Sunset	7,369	.682	.472	2.47	19.1
58	Kern River	3,501	.700	.425	4.13	10.3
59	Midway-Sunset	20,706	.713	.533	3.33	16.0
60	Kern River	521	.715	.446	2.14	20.9
61	Midway-Sunset	5,332	.723	.400	1.33	30.0
62	Kern River	7,402	.724	.335	2.84	11.8
63	Midway-Sunset	9,699	.734	.389	3.45	11.3
64	Santa Maria	9,727	.741	.653	2.50	26.1
65	Coalinga	2,495	.744	.202	3.09	6.6
66	Midway-Sunset	4,437	.747	.357	1.60	22.3
67	Midway-Sunset	30,161	.751	.612	4.15	14.8
68	Coalinga	[2]	.764	.348	4.42	7.9
69	Midway-Sunset	4,443	.769	.441	2.97	14.8
70	Kern River	3,188	.781	.353	18.87	18.7
71	Midway-Sunset	18,807	.784	.376	3.63	10.4
72	Coalinga	4,413	.793	.469	3.04	15.4
73	Coalinga	9,190	.799	.384	3.88	9.9
74	Los Angeles	3,025	.799	.080	.80	10.0
75	Kern River	1,961	.800	.481	1.53	31.4

[1] Loss.

[2] Number of wells not reported.

TABLE 43.—*Cost, net earnings, and investment per barrel based on production and rate of earnings on investment for petroleum producers in California, by companies, 1918*—Continued.

No. of company.	Field.	Annual production per well.	Average cost per barrel.	Net earnings per barrel.	Average investment per barrel.	Rate of earnings.
		Barrels.				*Per cent.*
76	Coalinga	4,067	$0.801	$0.404	$2.36	17.1
77	Coalinga	5,257	.808	.278	7.51	3.7
78	Midway-Sunset	22,985	.812	.371	6.39	5.8
79	Kern River	4,719	.813	.471	1.93	24.4
80	Coalinga	12,533	.839	.216	5.02	4.3
81	Los Angeles	25,555	.840	.307	1.30	23.6
82	Coalinga	4,165	.868	.236	2.92	8.1
83	Coalinga	12,585	.895	.242	4.37	5.5
84	Coalinga	4,489	.905	.218	2.27	9.6
85	Midway-Sunset	8,898	.910	.263	3.05	8.6
86	Los Angeles	5,965	.929	.366	30.30	1.2
87	Whittier-Fullerton	1,551	.935	.537	2.49	21.5
88	Kern River	3,415	.950	.150	3.39	4.4
89	Santa Maria	10,009	.953	.260	2.70	9.6
90	Kern River	5,738	.954	.146	1.08	13.5
91	Whittier-Fullerton	3,372	.985	.448	5.41	8.3
92	Ventura-Newhall	8,113	.985	.749	16.63	4.5
93	Midway-Sunset	7,105	.991	.124	.46	27.2
94	Midway-Sunset	4,450	1.006	.080	5.38	1.5
95	Coalinga	4,508	1.006	[1].055	2.33	[1]2.4
96	Kern River	2,275	1.017	.104	26.31	.4
97	Midway-Sunset	5,643	1.022	.186	5.33	3.5
98	Non-Separable	3,140	1.024	.222	5.34	4.2
99	Coalinga	10,338	1.025	.299	80.41	.4
100	Coalinga	17,139	1.084	.084	11.68	.7
101	Midway-Sunset	27,575	1.096	.024	13.24	.2
102	McKittrick	8,827	1.097	[1].115	13.06	[1].9
103	Whittier-Fullerton	1,974	1.108	.489	5.29	9.2
104	Coalinga	(2)	1.116	.005	11.50	.0
105	Non-Separable	2,986	1.133	[1].00	26.81	[1].0
106	Coalinga	13,590	1.137	.141	3.21	.4
107	Coalinga	5,722	1.139	[1].298	9.88	[1]3.0
108	Kern River	624	1.143	.086	7.76	1.1
109	Coalinga	2,946	1.175	[1].006	5.77	[1].1
110	Coalinga	9,412	1.210	[1].021	5.29	[1].4
111	Kern River	2,984	1.269	[1].230	7.38	[1]3.1
112	Midway-Sunset	3,881	1.270	[1].082	6.67	[1]1.2
113	Ventura-Newhall	12,829	1.304	.085	12.33	.7
114	McKittrick	805	1.307	[1].260	5.71	[1]4.6
115	Coalinga	1,230	1.316	[1].288	10.89	[1]2.6
116	Whittier-Fullerton	2,319	1.323	.054	3.44	1.6
117	Ventura-Newhall	1,722	1.335	[1].279	8.42	[1]3.3
118	Whittier-Fullerton	4,635	1.359	[1].238	3.85	[1]6.2
119	Whittier-Fullerton	1,430	1.368	.113	9.13	1.2
120	Coalinga	4,189	1.443	[1].358	6.42	[1]5.6
121	Ventura-Newhall	447	1.446	[1].487	11.49	[1]4.2
122	Santa Maria	42,690	1.508	[1].487	14.46	[1]3.4
123	Santa Maria	5,051	1.535	.885	5.23	16.9
124	Midway-Sunset	6,189	1.708	[1].455	15.14	[1]3.0
125	Midway-Sunset	3,273	1.843	[1].776	12.82	[1]6.1
126	Ventura-Newhall	4,223	1.889	[1].921	8.43	[1]10.9
127	Ventura-Newhall	4,177	2.181	[1]1.143	15.73	[1]7.3
128	McKittrick	7,327	2.252	[1]1.322	27.79	[1]4.8
129	McKittrick	5,230	2.253	[1].972	9.99	[1]9.7
130	Coalinga	1,819	2.781	[1]1.951	12.67	[1]15.4
131	Midway-Sunset	4,567	2.867	[1]4.115	5.18	[1]79.4
132	Midway-Sunset	6,643	4.196	[1]3.102	47.69	[1]6.5
133	Coalinga	3,402	4.666	[1]2.910	49.06	[1]5.9
341	Midway-Sunset	18,337	5.364	[1]3.816	53.34	[1]7.2

[1] Loss.

[2] Number of wells not reported.

TABLE 44.—*Tariff rates filed with Railroad Commission of California for transportation of crude petroleum by pipe lines, Jan. 1, 1920.*

Field.	Company.	From—	To—	Gravity minimum (°Baumé).	Rate per barrel.
Midway	Standard Oil Co. (California).	Midway Station and Signa.	Richmond	15	$0.35
Do	General Pipe Line Co	Pentland	Vernon or San Pedro.	17.5	.25
Do	do	do	Mojave	17.5	.125
Do	do	Midway	Vernon	17.5	.25
Do	do	do	Mojave	17.5	.125
Ventura-Newhall	Standard Oil Co. (California).	Pico Canyon	Ventura	22	.18
Do	General Pipe Line Co	Newhall	Vernon or San Pedro.	15.5	.25
Lost Hills	Standard Oil Co. (California).	Lost Hills	Richmond	18	.35
Whittier-Fullerton	do	Northam	El Segundo	18	.08
Kern River	do	Wait Station	Richmond	15	.35
Coalinga	do	Coalinga	do	18	.35
Do	Shell Co. of California	do	Martinez	18	.25

TABLE 45.—*Pipe-line costs of operation and rates for five companies in California, 1914–June 30, 1919.*

Company.	Year.	Shipping point.	Terminal point.	Cost.		Rate per barrel.
				Light.	Heavy.	
Standard Oil Co. (California).	1914	San Joaquin Valley Fields	Richmond Refinery	$0.142	$0.154	$0.35
	1915	do	do	114	.123	.35
	1916	do	do	125	.135	.35
	1917	do	do	157	.170	.35
	1918	do	do	220	.237	.35
	[1] 1919	do	do	213	.230	.35
Associated Oil Co.	1914	do	Avon Refinery	$0.115		.35
	1915	do	do	.111		.35
	1916	do	do	.126		.35
	1917	do	do	.131		.35
	1918	do	do	.194		.35
	[1] 1919	do	do	.221		.35
Union Oil Co. of California.	1915	do	Port San Luis	.060		.22½
	1916	do	do	.044		.22½
	1917	do	do	.089		.22½
	1918	do	do	.129		.22½
	[1] 1919	do	do	.133		.22½
General Petroleum Corp.[2]	1917	do	Vernon Refinery	.167		.25
	1918	do	do	.190		.25
	[1] 1919	do	do	.287		.25
Shell Co. of California.	1915	Coalinga Field	Martinez Refinery	.189		.15
	1916	do	do	.112		.15
	1917	do	do	.108		.15
	1918	do	do	.109		[3].25
	[1] 1919	do	do	.108		.25
Standard Oil Co. (California).	1914	Whittier-Fullerton Field	El Segundo Refinery	$0.024		.08
	1915	do	do	.034		.08
	1916	do	do	.033	$0.036	.08
	1917	do	do	.027	.029	.08
	1918	do	do	.021	.023	.08
	[1] 1919	do	do	.023	.925	.08
Associated Oil Co.	1914	Santa Maria Field	Gaviota Refinery	$0.063		.15
	1915	do	do	.075		.15
	1916	do	do	.061		.15
	1917	do	do	.136		.15
	1918	do	do	.103		.15
	[1] 1919	do	do	.094		.15
Union Oil Co. of California.	1915	do	Port San Luis	.056		.10
	1916	do	do	.071		.10
	1917	do	do	.060		.10
	1918	do	do	.083		.10
	[1] 1919	do	do	.084		.10

[1] First six months.
[2] General Pipe Line Co.
[3] Rate increased to 25 cents in February, 1918.

TABLE 46.—*Petroleum refineries in California, Jan. 1, 1920.*

Company.	Location of plant.	Date constructed.	Gross plant investment as at Dec. 31, 1919.	Rated daily capacity.	Crude oil run during 1919.	Products.						
						Gasoline.	Kerosene.	Fuel oil.	Lubricants.	Wax.	Asphalt.	Tops.
LARGE COMPANIES.				*Barrels.*	*Barrels.*							
Standard Oil Co. (California).	Richmond..	1901	$20,937,373.39	60,000	17,941,394	✓	✓	✓	✓	...	✓	...
	El Segundo.	1911	8,212,387.62	35,500	12,797,652	✓	✓	✓	✓	✓	✓	...
	Bakersfield..	1912	1,445,146.06	20,000	4,131,484	✓	...	✓	...	...	...	...
Total			30,594,907.07	115,500	34,870,530	...	...	...	...	...	...	...
Union Oil Co. of California.	Oleum	1895	7,198,375.16	22,000	4,903,147	✓	✓	✓	✓	...	✓	...
	Avila	1910		17,000	3,347,263	✓	...	✓	...	...	...	✓
	Brea	1911		10,000	3,406,391	✓	✓	✓	...	...	...	...
	Santa Paula.	1912		800	209,856	✓	...	✓	...	...	...	✓
	Maltha	1903		3,000	804,577	✓	✓	✓	...	...	...	...
	Los Angeles.	1919		12,000	76,309	✓	✓	✓	...	...	...	...
Total			7,198,375.16	64,800	12,747,543	...	...	...	...	...	...	...
Associated Oil Co.	Avon	1913	2,223,943.80	22,000	6,174,564	✓	✓	✓	...	...	...	...
	Gaviota	1899	611,260.89	10,000	477,289	...	...	✓	...	...	...	✓
	Los Angeles[1]	1904	362,145.31	10,000	[2] 589,000	...	...	✓	...	...	...	✓
Total			3,197,350.00	42,000	7,240,853	...	...	...	...	...	...	...
General Petroleum Corporation.	Vernon	1913	1,419,783.56	20,000	4,714,502	...	...	✓	...	...	...	✓
Shell Co. of California..	Martinez	1916	4,517,617.54	30,000	6,077,851	✓	✓	✓	✓	...	...	...
	Coalinga	1916		2,000	793,792	✓	✓	✓	...	...	...	...
Total			4,517,617.54	32,000	6,871,643	...	...	...	...	...	...	...
Total of above 5 companies (15 plants).			46,928,033.33	274,300	66,445,071	...	...	...	...	...	...	...
SMALL COMPANIES.												
American Oil Fields Co.	Fellows	1915	142,816.41	10,000	[2] 1,496,000	...	...	✓	...	...	...	✓
American Petroleum Co.	Coalinga	1917	45,593.95	3,600	[2] 1,160,000	...	...	✓	...	...	...	✓
Asphaltum & Oil Refining Co.	Los Angeles.	1917	11,862.13	500	61,766	✓	✓	✓	...	...	✓	...
California Fresno Oil Co.	Fresno	1902	34,000.00	500	63,481	✓	✓	✓	...	...	...	...
California Oil & Asphalt Co.	Vernon	1914	114,542.08	500	55,795	✓	✓	✓	...	...	...	...
Capital Crude Oil Co..	Santa Paula	1909	[3]	160	19,063	✓	✓	✓	...	...	...	...
Continental Petroleum Refining Co.	Coalinga	1919	218,421.60	3,000	306,539	✓	✓	✓	...	...	...	...
Fairchild-Gilmore-Wilton Co.	Vernon	...	[3]	700	[2] 30,000	...	...	✓	...	...	✓	...
A. F. Gilmore Co.	Los Angeles.	1915	295,240.31	260	[2] 75,000	✓	...	✓	...	...	...	...
Gilmore Petroleum Co.	....do	1915	57,878.09	300	7,515	✓	✓	✓	...	...	...	...
Jordan Oil Co	....do	1900	115,621.92	600	49,180	✓	✓	✓	...	...	...	...
King Refining Co.	Bakersfield..	1902	46,107.26	450	52,540	...	...	✓	✓	...	✓	...
Pioneer Paper Co.	Vernon	1907	[3]	400	[2] 48,000	...	...	✓	...	...	✓	...
Producers Refining Co.	Kern River.	1906	61,053.96	150	[2] 55,000	...	✓	✓	✓	...	✓	...
Puente Oil Co.	Chino	1898	48,206.43	1,000	211,596	✓	...	✓	...	...	...	...
Richfield Oil Co.	Los Angeles.	1916	160,577.99	900	49,761	✓	✓	✓	...	...	...	...
	Bakersfield..	1917		3,500	685,020	✓	✓	✓	...	...	...	...
St. Helens Petroleum Co.	Fullerton	...	[3]	600	[2] 91,000	...	...	✓	...	...	...	✓
Turner Oil Co.	Los Angeles.	1904	205,577.67	1,000	99,993	✓	✓	✓	✓	...	✓	...
Ventura Refining Co..	Fillmore	1915	1,172,639.49	3,000	1,170,129	✓	✓	✓	✓	✓	...	...
Vernon Oil Refining Co.	Los Angeles.	1916	50,954.41	1,500	300,168	✓	✓	✓	...	...	...	...
Wilshire Oil Co. (Inc.).	....do	1916	309,099.31	500	[2] 85,000	✓	✓	✓	...	...	...	...
	Fellows	1918		500		✓	...	✓	...	...	...	✓
Total of 21 small companies.		[4]	3,090,193.01	33,620	6,172,546	...	...	...	...	...	...	...
Total State, 26 companies (38 plants).		[4]	50,018,226.34	307,920	72,617,617	...	...	...	...	...	...	...

[1] Owned by Amalgamated Oil Co., which is controlled by the Associated Oil Co.
[2] Estimated.
[3] Figures on the gross plant investment not available.
[4] Does not include investment in four small plants—one light products, one topping, and two asphalt.

TABLE 47.—*Quantity and proportion of principal refined products obtained from California crude petroleum, 1916–1920.*

Product.	1916		1917		1918	
	Gallons.	Per cent.	Gallons.	Per cent.	Gallons.	Per cent.
Crude petroleum run	2,643,905,334	.....	3,063,888,450	.....	2,791,528,698	.....
Crude equivalent run	.....	.....	.....	.....	145,777,672	.....
Total run	2,643,905,334	.....	3,063,888,450	.....	2,937,306,370	.....
Gasoline and naphtha	309,480,999	11.70	386,821,866	12.63	434,392,494	14.79
Kerosene	129,186,582	4.89	149,192,933	4.87	102,580,454	3.49
Fuel oil and gas oil	1,879,963,164	71.10	2,169,808,489	70.82	2,133,784,156	72.65
Lubricating oil	41,429,876	1.57	78,445,455	2.56	66,940,253	2.28
Other products	236,820,143	8.96	221,272,593	7.22	133,719,833	4.55
Total products	2,596,880,764	98.22	3,005,541,336	98.10	2,871,417,190	97.76
Refining loss	47,024,570	1.78	58,347,114	1.90	65,889,180	2.24
Total	2,643,905,334	100.00	3,063,888,450	100.00	2,937,306,370	100.00

Product.	1919		1920	
	Gallons.	Per cent.	Gallons.	Per cent.
Crude petroleum run	3,063,188,184	.....	3,233,310,160	.....
Crude equivalent run	146,070,941	.....	.....	.....
Total run	3,209,259,125	.....	3,233,310,160	.....
Gasoline and naphtha	417,792,940	13.02	496,425,909	15.35
Kerosene	241,547,188	7.53	207,462,688	6.42
Fuel oil and gas oil	2,300,539,701	71.68	2,205,955,551	68.22
Lubricating oil	65,614,950	2.04	92,021,707	2.85
Other products	112,329,444	3.50	154,195,889	4.77
Total products	3,137,824,223	97.77	3,156,061,744	97.61
Refining loss	71,434,902	2.23	77,248,416	2.39
Total	3,209,259,125	100.00	3,233,310,160	100.00

TABLE 48.—*Quantity and proportion of principal refined products produced by five large refining companies, 1916–1919.*

Product.	1916			1917		
	Total for State.	Five large companies.	Per cent.	Total for State.	Five large companies.	Per cent.
	Gallons.	*Gallons.*		*Gallons.*	*Gallons.*	
Gasoline	309,480,999	181,917,525	91.5	386,821,866	249,094,594	91.3
Engine distillate		101,128,651			103,977,812	
Kerosene	129,186,582	125,450,703	97.1	149,192,933	146,167,121	98.0
Fuel and gas oil	1,879,963,164	1,826,346,908	97.1	2,169,808,489	2,083,609,585	96.0
Lubricating oil	41,429,876	31,673,120	76.4	78,445,455	43,807,048	55.8
Other products (including unfinished oils)	236,820,143	106,205,618	44.8	221,272,593	126,288,007	57.1
Refining loss	47,024,570	45,775,982	97.3	58,347,114	55,467,542	95.1
Total runs	2,643,905,334	2,418,498,507	91.4	3,063,888,450	2,808,411,709	91.7

TABLE 48.—*Quantity and proportion of principal refined products produced by five large refining companies, 1916–1919*—Continued.

Product.	1918			1919		
	Total for State.	Five large companies.	Per cent.	Total for State.	Five large companies.	Per cent.
	Gallons.	*Gallons.*		*Gallons.*	*Gallons.*	
Gasoline	434,392,494	304,080,906	96.3	417,792,940	313,877,973	97.1
Engine distillate		114,119,257			91,715,531	
Kerosene	102,580,454	97,301,743	94.9	241,547,188	237,559,216	98.3
Fuel and gas oil	2,133,784,156	1,878,633,037	88.0	2,300,539,701	2,050,438,334	89.1
Lubricating oil	66,940,253	63,866,117	95.4	65,614,950	56,167,250	85.6
Other products (including unfinished oils)	133,719,833	117,843,167	88.1	112,329,444	109,877,265	97.8
Refining loss	65,889,180	54,653,114	82.9	71,434,902	63,638,331	89.1
Total runs	2,937,306,370	2,630,497,341	89.6	3,209,259,125	2,923,273,900	91.1

TABLE 49.—*Refinery yields for four large companies in California, 1916–June 30, 1919.*

Product.	Company "A."				Company "B."			
	1916	1917	1918	1919[1]	1916	1917	1918	1919[1]
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Gasoline	7.17	8.35	11.12	14.88	3.30	3.75	4.14	5.06
Engine distillate	5.26	7.55	8.48	7.31	3.41	2.89	2.97	1.42
Kerosene	.....	.....	.26	.53	10.16	3.43	.60	6.60
Fuel oil and gas oil	79.99	77.27	73.11	71.88	73.79	74.66	72.33	79.05
Lubricating oil	.....	.04	.17	.....	1.02	2.21	4.01	2.15
Asphaltum	.....	.....	.....	.....	.31	.22	.....	.....
Other products	6.85	5.60	5.35	4.07	6.29	11.11	13.62	3.76
Refining loss	.73	1.19	1.51	1.33	1.72	1.73	2.33	1.96
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Product.	Company "C."				Company "D."			
	1916	1917	1918	1919[1]	1916	1917	1918	1919[1]
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Gasoline	7.21	10.12	12.78	11.18	11.07	11.27	12.03	10.66
Engine distillate	4.18	3.10	4.13	2.51	3.65	4.78	4.69	4.85
Kerosene	6.55	7.94	6.33	12.79	1.78	2.27	1.44	2.38
Fuel oil and gas oil	67.42	66.47	64.52	65.90	75.10	73.45	75.31	73.77
Lubricating oil	1.88	2.16	3.50	2.97	.50	.69	.68	.47
Asphaltum	1.46	1.29	1.13	1.65	2.17	1.57	1.16	2.21
Other products	9.66	7.10	5.49	.56	2.34	2.48	2.06	3.25
Refining loss	1.64	1.82	2.12	2.44	3.39	3.49	2.63	2.41
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[1] First 6 months.

TABLE 50.—*Refinery yields for four complete refining plants consuming California crude petroleum, 1916–June 30, 1919.*

Product.	Plant "A."				Plant "B."			
	1916	1917	1918	1919[1]	1916	1917	1918	1919[1]
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Gasoline	7.33	9.37	10.60	8.51	13.07	15.48	15.97	16.09
Engine distillate	6.80	4.05	4.11	3.88	.72	1.77	3.68	1.85
Kerosene	11.00	13.76	9.66	15.52	2.66	2.23	2.32	8.12
Fuel and gas oil	64.70	61.60	62.05	60.52	73.23	74.30	67.02	68.34
Lubricating oil	3.08	3.64	5.63	5.36	.94	.79	.87	.89
Asphaltum	1.72	2.14	1.56	1.59	1.35	.48	.64	.89
Other products	3.20	3.42	3.66	1.68	6.66	2.93	7.48	1.67
Refining loss	2.17	2.02	2.73	2.94	1.37	2.02	2.02	2.15
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Product.	Plant "C."				Plant "D."			
	1916	1917	1918	1919[1]	1916	1917	1918	1919[1]
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Gasoline	15.14	16.71	20.09	17.54	2.90	3.58	3.97	5.27
Engine distillate	6.64	7.58	7.83	8.66	10.22	14.41	17.14	1.34
Kerosene	3.23	4.94	3.05	5.56	10.57	3.80	.65	5.31
Fuel and gas oil	62.08	57.11	58.59	55.27	73.52	73.58	71.38	[2] 82.09
Lubricating oil	1.00	1.53	1.45	1.05	.87	2.48	4.39	3.66
Asphaltum	4.33	3.48	2.47	5.35	.17	.25	.....	.....
Other products	2.55	3.33	2.97	3.17	.....	.....	.....	.....
Refining loss	5.03	5.32	3.55	3.40	1.75	1.90	2.47	2.33
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[1] First 6 months.

[2] Includes some stove oil.

TABLE 51.—*Cost of crude petroleum and cost of refining, as revised by the Commission, 1914–June 30, 1919.*

	Crude run.[1]	Crude cost.	Refinery operating.	General and administrative.	Depreciation.	Total operating.	Total cost.
1914:	*Barrels.*						
Commission's figures	36,322,623	$21,655,470.90	$3,696,859.11	$1,112,719.43	$823,859.29	$5,633,437.83	$27,288,908.73
Company's figures	36,322,623	30,460,231.45	3,696,859.11	1,112,719.43	607,933.44	5,417,511.98	35,877,743.43
Difference		8,804,760.55			215,925.85	215,925.85	8,588,834.70
1915:							
Commission's figures	48,004,265	26,878,667.08	4,243,293.18	1,306,648.91	1,068,224.00	6,618,166.09	33,496,833.17
Company's figures	48,004,265	33,595,812.13	4,243,293.18	1,306,648.91	820,207.07	6,370,149.16	39,965,961.29
Difference		6,717,145.05			248,016.93	248,016.93	6,469,128.12
1916:							
Commission's figures	57,583,323	33,787,265.01	5,383,759.29	1,992,409.66	1,355,782.44	8,731,951.39	42,519,216.40
Company's figures	57,583,323	55,388,445.62	5,383,759.29	1,992,409.66	1,142,382.05	8,518,551.00	63,906,996.62
Difference		21,601,180.61			213,400.39	213,400.39	21,387,780.22
1917:							
Commission's figures	66,909,484	49,988,433.79	8,048,699.51	3,459,039.05	1,539,313.74	13,047,052.30	63,035,486.09
Company's figures	66,909,484	83,600,249.24	8,048,699.51	3,459,039.05	1,404,747.86	12,912,486.42	96,512,735.66
Difference		33,611,815.45			134,565.88	134,565.88	33,477,249.57
1918:							
Commission's figures	62,245,140	55,486,977.23	10,596,931.07	4,218,332.19	1,765,447.72	16,580,710.98	72,067,688.21
Company's figures	62,245,140	93,910,734.98	10,596,931.07	4,218,332.19	1,690,218.55	16,505,481.81	110,416,216.79
Difference		38,423,757.75			75,229.17	75,229.17	38,348,528.58
1919:[2]							
Commission's figures	32,850,104	30,626,274.17	7,302,029.15	2,506,782.97	932,480.57	10,741,292.69	41,367,566.86
Company's figures	32,850,104	53,503,193.57	7,302,029.15	2,506,782.97	899,656.64	10,708,468.76	64,211,662.33
Difference		22,876,919.40			32,823.93	32,823.93	22,844,095.47

[1] Includes purchased unfinished oil rerun.

[2] First 6 months.

TABLE 52.—*Detailed cost of refining a barrel of crude petroleum, by companies, 1914–June 30, 1919.*

Year.	Crude oil cost.		Operating cost.								Total cost.	
			Refinery operating expense.		General and administrative expense.		Depreciation.		Total operating expense.			
	Per bbl.	Index No.	Per bbl.	Index No.	Per bbl.	Index No.	Per bbl.	Index No.	Per bbl.	Index No.	Per bbl.	Index No.
Company "A":												
1914	$0.702	100	$0.042	100	$0.011	100	$0.014	100	$0.067	100	$0.769	100
1915	.593	85	.034	80	.011	99	.014	103	.059	88	.652	85
1916	.789	112	.035	84	.009	76	.012	85	.056	83	.845	110
1917	1.083	154	.061	146	.013	113	.013	91	.087	129	1.170	152
1918	1.223	174	.090	214	.018	157	.015	107	.123	182	1.346	175
1919[1]	1.492	213	.099	235	.022	192	.018	130	.139	206	1.631	212
Company "B":												
1916	.453	100	.082	100	.039	100	.028	100	.149	100	.602	100
1917	.492	109	.086	106	.032	81	.026	90	.144	97	.636	106
1918	.723	160	.120	147	.035	88	.028	101	.183	123	.906	150
1919[1]	.753	166	.110	135	.059	149	.028	98	.197	132	.950	158
Company "C":												
1914	.581	100	.110	100	.034	100	.024	100	.168	100	.749	100
1915	.522	90	.094	85	.033	98	.025	107	.152	91	.674	90
1916	.546	94	.109	99	.049	147	.031	131	.189	113	735	98
1917	.719	129	.147	134	.080	238	.031	132	.258	154	.977	131
1918	.784	135	.223	202	.107	321	.041	170	.371	221	1.155	154
1919[1]	.860	148	.290	263	.114	341	.039	164	.443	265	1.303	174
Company "D":												
1916	.631	100	.114	100	.012	100	.012	100	.138	100	.769	100
1917	.765	121	.136	119	.015	125	.013	108	.164	119	.929	121
1918	.998	158	.154	135	.023	192	.015	125	.192	139	1.190	155
1919[1]	.943	149	.233	204	.023	192	.015	125	.271	196	1.214	158
Company "E":												
1916	.577	100	.040	100	.019	100	.002	100	.061	100	.638	100
1917	.715	124	.062	155	.027	143	.003	159	.092	151	.807	126
1918	1.036	180	.082	206	.047	246	.006	268	.135	221	1.171	183
1919[1]	.934	162	.080	201	.051	269	.006	259	.137	224	1.071	168
Total five companies:												
1914	.596	100	.102	100	.030	100	.023	100	.155	100	.751	100
1915	.560	94	.089	87	.027	89	.022	98	.138	89	.698	93
1916	.586	98	.094	92	.035	113	.023	104	.152	98	.738	98
1917	.747	125	.120	118	.052	169	.023	101	.195	126	.942	125
1918	.892	150	.170	167	.068	222	.028	125	.266	172	1.158	154
1919[1]	.932	156	.222	218	.076	249	.029	125	.327	211	1.259	168

[1] First 6 months.

TABLE 53.—*Combined f. o. b. refinery realizations of principal petroleum products for five large companies, 1914–June 30, 1919.*

Product.	Gallons.	Amount.	Average realization per gallon.
1914:			
Gasoline	97,052,639	$8,835,113.43	$0.091
Engine distillate	2,742,761	90,989.01	.033
Kerosene	176,404,480	6,739,632.28	.038
Fuel oil	1,284,622,030	18,576,443.20	.015
Gas oil	28,924,982	529,227.33	.018
Lubricating oil	13,489,582	2,170,778.88	.161
Asphaltum	14,993,541	501,299.98	.033
Other products	29,811,478	1,292,370.45	.043
Total	1,648,041,493	38,735,854.56	.024
1915:			
Gasoline	163,115,742	12,243,256.38	.075
Engine distillate	22,789,764	1,011,882.11	.044
Kerosene	127,958,258	5,164,988.45	.040
Fuel oil	1,518,738,036	20,680,656.63	.014
Gas oil	27,370,292	535,575.14	.020
Lubricating oil	20,968,372	3,092,186.77	.148
Asphaltum	28,729,202	956,876.82	.033
Other products	23,688,165	798,773.13	.034
Total	1,933,357,831	44,484,195.43	.023
1916:			
Gasoline	173,184,653	24,582,145.69	.142
Engine distillate	108,369,268	6,239,491.72	.058
Kerosene	133,903,123	6,751,663.88	.050
Fuel oil	1,984,320,285	27,899,500.18	.014
Gas oil	32,466,657	775,488.21	.024
Lubricating oil	33,105,003	4,655,426.74	.141
Asphaltum	30,811,553	1,000,580.33	.033
Other products	45,650,374	2,527,982.65	.055
Total	2,541,810,916	74,432,279.40	.029
1917:			
Gasoline	241,238,055	38,061,267.41	.158
Engine distillate	122,947,175	8,040,452.86	.065
Kerosene	137,187,554	6,716,392.45	.049
Fuel oil	2,201,631,211	41,557,791.89	.019
Gas oil	37,810,514	1,139,421.12	.030
Lubricating oil	44,445,806	7,239,589.77	.163
Asphaltum	30,774,486	1,222,490.74	.040
Other products	69,197,896	5,239,916.26	.076
Total	2,885,232,697	109,217,322.50	.038
1918:			
Gasoline	294,810,817	46,501,151.86	.158
Engine distillate	132,120,439	9,524,330.36	.072
Kerosene	111,611,793	5,734,286.86	.051
Fuel oil	2,147,739,100	60,924,416.85	.028
Gas oil	29,722,676	1,390,125.23	.047
Lubricating oil	65,558,914	11,513,219.29	.176
Asphaltum	20,861,493	1,096,118.49	.053
Other products	77,780,744	7,228,006.56	.093
Total	2,880,205,976	143,911,655.50	.050
1919:[1]			
Gasoline	150,083,743	22,745,545.35	.152
Engine distillate	48,058,035	3,895,180.73	.081
Kerosene	102,023,523	5,328,162.27	.052
Fuel oil	882,035,470	30,640,826.58	.035
Gas oil	17,985,649	869,722.43	.048
Lubricating oil	26,578,200	5,454,065.15	.205
Asphaltum	8,579,963	606,781.37	.071
Other products	26,445,437	2,509,616.40	.095
Total	1,261,790,020	72,049,900.28	.057

[1] First 6 months.

TABLE 54.—*Refinery investment, as shown by companies' records and as revised by Commission, for five large companies, 1914–June 30, 1919.*

Company and item.	1914, Dec. 31.	1915, Dec. 31.	1916, Dec. 31.
Standard Oil Co. (California):			
Gross plant investment	$16,961,518.99	$19,518,663.82	$21,613,971.87
Accrued depreciation shown by company	2,649,621.43	3,538,160.18	4,451,821.31
Net plant investment shown by company	14,311,897.56	15,980,503.64	17,162,150.56
Depreciation adjustment to 5 per cent basis	[1] 234,046.88	[1] 513,494.08	[1] 912,035.52
Net plant investment with depreciation at 5 per cent	14,077,850.68	15,467,009.56	16,250,115.04
Refinery pro rata of general office investment	293,477.18	329,599.76	374,930.60
Net working capital reported by company	19,484,859.66	19,945,891.61	20,380,991.54
Total refinery investment	33,856,187.52	35,742,500.93	37,006,037.18
Union Oil Co. of California:			
Gross plant investment	2,453,763.72	2,526,229.09	3,275,807.97
Accrued depreciation shown by company	217,451.46	326,287.89	461,942.17
Net plant investment shown by company	2,236,312.26	2,199,941.20	2,813,865.80
Depreciation adjustment to 5 per cent basis	.....	4,146.62	90,599.44
Net plant investment with depreciation at 5 per cent	2,236,312.26	2,204,087.82	2,904,465.24
Net working capital reported by company	571,000.37	798,965.50	1,103,438.25
Total refinery investment	2,807,312.63	3,003,053.32	4,007,903.49
Shell Co. of California:			
Gross plant investment	.....	.....	3,196,282.40
Accrued depreciation shown by company	.....	.....	270,478.67
Net plant investment shown by company	.....	.....	2,925,803.73
Depreciation adjustment to 5 per cent basis	.....	.....	63,031.70
Net plant investment with depreciation at 5 per cent	.....	.....	2,988,835.43
Net working capital reported by company	.....	.....	1,990,279.86
Total refinery investment	.....	.....	4,979,115.29
Associated Oil Co.:			
Gross plant investment	1,467,925.81	1,645,345.82	2,065,787.80
Accrued depreciation shown by company	160,857.41	223,432.89	316,811.12
Net plant investment shown by company	1,307,068.40	1,421,912.93	1,748,976.68
Depreciation adjustment to 5 per cent basis	18,121.03	45,404.68	76,318.60
Net plant investment with depreciation at 5 per cent	1,325,189.43	1,467,317.61	1,825,295.28
Refinery pro rata of other fixed assets	85,726.72	105,725.72	150,499.91
Net working capital reported by company	261,165.56	237,629.23	554,912.64
Total refinery investment	1,672,081.71	1,810,672.56	2,530,707.83
General Petroleum Corporation:			
Gross plant investment	.....	.....	458,845.16
Accrued depreciation shown by company	.....	.....	11,281.50
Net plant investment shown by company	.....	.....	447,563.66
Depreciation adjustment to 5 per cent basis	.....	.....	4,742.61
Net plant investment with depreciation at 5 per cent	.....	.....	452,306.27
Net working capital reported by company	.....	.....	140,769.25
Total refinery investment	.....	.....	593,075.52
Total (five companies):			
Gross plant investment	20,883,208.52	23,690,238.73	30,610,695.20
Accrued depreciation shown by companies	3,027,930.30	4,087,880.96	5,512,334.77
Net plant investment shown by companies	17,855,278.22	19,602,357.77	25,098,360.43
Depreciation adjustment to 5 per cent basis	[1] 215,925.85	[1] 463,942.78	[1] 677,343.17
Net plant investment with depreciation at 5 per cent	17,639,352.37	19,138,414.99	24,421,017.26
Refinery pro rata of other fixed assets	379,203.90	435,325.48	525,430.51
Net working capital reported by companies	20,317,025.59	20,982,486.34	24,170,391.54
Total refinery investment	38,335,581.86	40,556,226.81	49,116,839.31

[1] Deduction.

TABLE 54.—*Refinery investment, as shown by companies' records and as revised by Commission, for five large companies, 1914–June 30, 1919*—Continued.

Company and item.	1917, Dec. 31.	1918, Dec. 31.	1919, June 30.
Standard Oil Co. (California):			
Gross plant investment	$24,580,082.92	$27,926,918.12	$29,441,626.52
Accrued depreciation shown by company	5,509,745.55	6,627,729.14	7,263,202.29
Net plant investment shown by company	19,070,337.37	21,299,188.98	22,178,424.23
Depreciation adjustment to 5 per cent basis	[1] 1,378,533.22	[1] 1,848,719.75	[1] 2,078,433.91
Net plant investment with depreciation at 5 per cent	17,691,804.15	19,450,469.23	20,099,990.32
Refinery pro rata of general office investment	362,479.57	378,477.16	371,612.04
Net working capital reported by company	19,721,126.68	21,935,289.86	25,084,128.10
Total refinery investment	37,775,410.40	41,764,236.25	45,555,730.46
Union Oil Co. of California:			
Gross plant investment	3,937,585.65	5,045,682.86	5,800,777.34
Accrued depreciation shown by company	613,459.26	852,606.56	993,597.69
Net plant investment shown by company	3,324,126.39	4,193,076.30	4,807,179.65
Depreciation adjustment to 5 per cent basis	190,115.78	315,917.09	367,592.11
Net plant investment with depreciation at 5 per cent	3,514,242.17	4,508,993.39	5,174,771.76
Net working capital reported by company	2,027,271.38	1,518,465.20	1,637,581.93
Total refinery investment	5,541,513.55	6,027,458.59	6,812,353.69
Shell Co. of California:			
Gross plant investment	3,575,035.40	4,045,536.51	4,267,427.90
Accrued depreciation shown by company	593,401.02	1,053,573.88	1,259,999.27
Net plant investment shown by company	2,981,634.38	2,991,962.63	3,007,428.63
Depreciation adjustment to 5 per cent basis	236,670.29	417,221.91	521,292.97
Net plant investment with depreciation at 5 per cent	3,218,304.67	3,409,184.54	3,528,721.60
Net working capital reported by company	1,835,468.25	2,906,630.83	4,126,698.44
Total refinery investment	5,053,772.92	6,315,815.37	7,655,420.04
Associated Oil Co.:			
Gross plant investment	2,236,410.88	2,319,071.80	2,534,518.80
Accrued depreciation shown by company	408,463.56	508,677.71	560,314.43
Net plant investment shown by company	1,827,947.32	1,810,394.09	1,974,204.37
Depreciation adjustment to 5 per cent basis	125,696.15	192,401.17	222,822.90
Net plant investment with depreciation at 5 per cent	1,953,643.47	2,002,795.26	2,197,027.27
Refinery pro rata of other fixed assets	162,740.44	190,403.18	238,767.13
Net working capital reported by company	115,180.08	216,494.64	208,500.76
Total refinery investment	2,231,563.99	2,409,693.08	2,644,295.16
General Petroleum Corporation:			
Gross plant investment	922,473.19	1,271,298.18	1,225,079.11
Accrued depreciation shown by company	39,573.23	95,654.05	129,896.58
Net plant investment shown by company	882,899.96	1,175,644.13	1,095,182.53
Depreciation adjustment to 5 per cent basis	14,141.96	36,040.35	46,762.77
Net plant investment with depreciation at 5 per cent	897,041.92	1,211,684.48	1,141,945.30
Net working capital reported by company	578,226.53	585,023.15	609,548.61
Total refinery investment	1,475,268.45	1,796,707.63	1,751,493.91
Total (five companies):			
Gross plant investment	35,251,588.04	40,608,507.47	43,269,429.67
Accrued depreciation shown by companies	7,164,642.62	9,138,241.34	10,207,010.26
Net plant investment shown by companies	28,086,945.42	31,470,266.13	33,062,419.41
Depreciation adjustment to 5 per cent basis	[1] 811,909.04	[1] 887,139.23	[1] 919,963.16
Net plant investment with depreciation at 5 per cent	27,275,036.38	30,583,126.90	32,142,456.25
Refinery pro rata of other fixed assets	525,220.01	568,880.34	610,379.17
Net working capital reported by companies	24,277,272.92	27,161,903.68	31,666,457.84
Total refinery investment	52,077,529.31	58,313,910.92	64,419,293.26

[1] Deduction.

TABLE 55.—*Refinery investment per barrel of crude petroleum consumed for five large companies, 1914–June 30, 1919.*

Company.	Year.	Refinery investment.	Crude and purchased unfinished oils run.	Average per barrel (annual basis).
			Barrels.	
Standard Oil Co. (California)	1914	$33,856,187.52	31,782,578	$1.065
	1915	35,742,500.93	34,462,093	1.037
	1916	37,006,037.18	31,504,262	1.175
	1917	37,775,410.40	35,161,352	1.074
	1918	41,764,236.25	30,334,241	1.354
	[1] 1919	45,555,730.46	16,939,461	1.345
Shell Co. of California	1914			
	1915			
	1916	4,979,115.29	5,850,150	.851
	1917	5,053,772.92	6,687,845	.756
	1918	6,315,815.37	6,793,182	.930
	[1] 1919	7,655,420.04	3,675,073	1.042
Union Oil Co. of California	1914			
	1915	3,003,053.32	8,469,813	.355
	1916	4,007,903.49	9,865,845	.406
	1917	5,541,513.55	10,164,374	.545
	1918	6,027,458.59	11,668,208	.517
	[1] 1919	6,812,353.69	6,112,202	.558
Associated Oil Co	1914	1,672,081.71	4,540,045	.368
	1915	1,810,672.56	5,072,359	.357
	1916	2,530,707.83	7,928,189	.319
	1917	2,231,563.99	8,155,207	.274
	1918	2,409,693.08	7,126,987	.338
	[1] 1919	2,644,295.16	3,250,556	.407
General Petroleum Corporation	1914			
	1915			
	1916	593,075.52	[2] 2,934,877	.102
	1917	1,475,268.45	6,740,706	.219
	1918	1,796,707.63	5,822,522	.309
	[1] 1919	1,751,493.91	2,894,971	.303
Total of all companies	1914	35,528,269.23	36,322,623	.978
	1915	40,556,226.81	48,004,265	.845
	1916	49,116,839.31	57,583,323	.853
	1917	52,077,529.31	66,909,494	.778
	1918	58,313,910.92	62,245,140	.937
	[1] 1919	64,419,293.26	32,872,263	.980

[1] First six months.

[2] Last six months.

TABLE 56.—*Marketing investment for four large marketing companies, 1914–June 30, 1919.*

Company and item.	1914, Dec. 31.	1915, Dec. 31.	1916, Dec. 31.
Standard Oil Co. (California):			
Gross plant investment	$6,799,494.15	$7,487,119.76	$9,017,846.70
Accrued depreciation	1,195,856.57	1,657,941.17	2,180,658.79
Net plant investment	5,603,637.58	5,829,178.59	6,837,187.91
Marketing pro rata of general office investment	114,932.07	120,222.86	149,379.36
Net working capital	8,373,139.06	8,009,191.61	10,846,494.02
Net marketing investment, including working capital	14,091,708.71	13,958,593.06	17,833,061.29
Union Oil Co. of California:			
Gross plant investment	3,721,385.92	4,051,013.01	4,223,631.51
Accrued depreciation	303,329.72	390,101.43	576,543.42
Net plant investment	3,418,056.20	3,660,911.58	3,647,088.09
Net working capital	6,412,490.22	7,324,697.53	10,249,525.22
Net marketing investment, including working capital	9,830,546.42	10,985,609.11	13,896,613.31
Associated Oil Co.:			
Gross plant investment	1,823,043.88	2,006,147.16	2,197,942.18
Accrued depreciation	614,054.56	766,283.50	787,719.14
Net plant investment	1,208,989.32	1,239,863.66	1,410,223.04
Net working capital	4,370,461.41	3,444,499.05	3,260,812.65
Net marketing investment, including working capital	5,579,450.73	4,684,362.71	4,671,035.69
Shell Co. of California:			
Gross plant investment	.....	.....	1,531,414.30
Accrued depreciation	.....	.....	350,071.66
Net plant investment	.....	.....	1,181,342.64
Net working capital	.....	.....	896,878.65
Net marketing investment, including working capital	.....	.....	2,078,221.29
Combined investment for four companies:			
Gross plant investment	12,343,923.95	13,544,279.93	16,970,834.69
Accrued depreciation	2,113,240.85	2,814,326.10	3,894,993.01
Net plant investment	10,230,683.10	10,729,953.83	13,075,841.68
Marketing pro rata of general office investment	114,932.07	120,222.86	149,379.36
Net working capital	19,156,090.69	18,778,388.19	25,253,710.54
Net marketing investment, including working capital	29,501,705.86	29,628,564.88	33,478,931.58

TABLE 56.—*Marketing investment for four large marketing companies, 1914–June 30, 1919*—Continued.

Company and item.	1917, Dec. 31.	1918, Dec. 31.	1919, June 30.
Standard Oil Co. (California):			
Gross plant investment	$10,616,305.59	$12,146,001.15	$13,248,298.93
Accrued depreciation	2,759,525.29	3,462,765.98	3,843,286.56
Net plant investment	7,856,780.30	8,683,235.17	9,405,012.37
Marketing pro rata of general office investment	149,293.95	154,330.49	157,619.12
Net working capital	12,942,986.91	15,017,876.73	14,409,918.02
Net marketing investment, including working capital	20,949,061.16	23,855,442.39	23,972,549.51
Union Oil Co. of California:			
Gross plant investment	5,010,900.46	6,461,451.83	7,007,819.12
Accrued depreciation	871,302.39	1,098,179.10	1,482,718.55
Net plant investment	4,139,598.07	5,363,272.73	5,525,100.57
Net working capital	11,830,759.41	14,119,439.94	14,138,117.42
Net marketing investment, including working capital	15,970,357.48	19,482,712.67	19,663,217.99
Associated Oil Co.:			
Gross plant investment	2,299,425.43	2,313,218.07	2,476,009.69
Accrued depreciation	933,062.31	986,714.03	972,954.05
Net plant investment	1,366,363.12	1,326,504.04	1,503,055.64
Net working capital	3,337,848.78	5,103,467.03	6,361,625.82
Net marketing investment, including working capital	4,704,211.90	6,429,971.07	7,864,681.46
Shell Co. of California:			
Gross plant investment	1,898,348.29	1,939,340.27	2,022,603.92
Accrued depreciation	555,524.80	714,861.07	890,545.20
Net plant investment	1,342,823.49	1,224,479.20	1,132,058.72
Net working capital	851,555.50	1,095,251.45	904,359.04
Net marketing investment, including working capital	2,194,378.99	2,319,730.65	2,036,417.76
Combined investment for four companies:			
Gross plant investment	19,824,979.77	22,860,011.32	24,754,731.66
Accrued depreciation	5,119,414.79	6,262,520.18	7,189,504.36
Net plant investment	14,705,564.98	16,597,491.14	17,565,227.30
Marketing pro rata of general office investment	149,293.95	154,330.49	157,619.12
Net working capital	28,963,150.60	35,336,035.15	35,814,020.30
Net marketing investment, including working capital	43,818,009.53	52,087,856.78	53,536,866.72